Designing a Citizen Science Platform for Venice

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Table of Contents

1. Citizen Science in Venice

There are many different definitions of citizen science but the unifying theme is public participation in scientific research (Socientize Consortium, 2013). Citizen science allows for more data collection than one team of scientists could accomplish alone. Citizen science can help researchers study complex topics such as climate change, which cover immense spatial and temporal scales (Dickinson et al., 2010).

In Venice, Italy, citizen science is a rising field of interest. Higher Education Institutions, such as the Venice International University and the Ca' Foscari University of Venice, have begun studying the role citizen science plays in research (Venice International University, n.d.; Ca' Foscari University of Venice, 2020b). Within the community itself, citizen science projects focus on the conservation and preservation of the lagoon, an intrinsic piece to Venice's culture, art, and history (UNESCO, n.d.). One citizen science project enabled scientists to identify a new species of jellyfish and monitor invasive species in the lagoon (PERSEUS, n.d.). Another project, which occurred during the COVID-19 lockdown, asked Venetians to submit photos of the lagoon, canals, flora and fauna so the Ca' Foscari University (2020a) could analyze the effects of a reduced human presence.

The sponsor of our project, Venice Calls, plays an important role in the engagement of young people with the Venetian community at large. Their projects address environmental, social, and economic issues in the city by organizing social projects, events, conferences, emergency actions, and hackathons with the community. Their goal through these projects is to raise awareness and share experiences with Venetians (Venice Calls, n.d.). Last year, Venice Calls and Worcester Polytechnic Institute (WPI) collaborated on a project called "Plastic Free Venice: Quantifying and Mapping Plastic Pollution" in 2019. Together, they developed methods for reducing pollution and improving waste management efficiency (Bonanno et al., 2019).

Thus far, all of the very commendable citizen science efforts in Venice have not been coordinated and widely shared. A single comprehensive platform where all users can discover and participate in citizen science projects operating in the Lagoon could stimulate collaboration between organizations and help ensure Venice's culture and history last for years to come.

In addition to being a central hub for citizen science projects in the Lagoon, a platform could also provide useful visualizations of data gathered throughout the various projects. These visualizations would make the data more accessible to everyone. Having accurate information would inform both day-to-day decisions as well as long term policy. Research has shown that building local awareness through participation and decision-making will contribute to buy-in and better agreement on solutions (Socientize Consortium, 2013; Den Broeder, 2018). Data visualizations have also proved to be the key to understanding data and informing citizens on the progress of citizen science projects (Trafton, 2014).

To that end, the goal of this project is to design a digital platform for promoting and visualizing citizen science projects that address environmental, social, and economic problems in Venice. We identified user types and user journeys, analyzed features in existing platforms, and used the Iterative Design Process to refine our design. We finished with recommendations for design improvements and platform development. We hope our project will contribute to future citizen science efforts in Venice and its Lagoon.

2. What Citizen Science Is

Citizen science is the public participation in scientific research (Socientize Consortium, 2013). This chapter details the types of citizen science, the benefits of citizen science, the current citizen science projects happening in Venice.

2.1 Types of Citizen Science

There are three main ways citizens contribute to citizen science projects: classification, data collection, and instrumentation. Existing citizen science platforms like Zooniverse and iNaturalist focus on one type of citizen science (classification and data collection respectively) but our platform will be flexible enough to house all three.

2.1.2 Classification

Classification is the sole type of citizen science on Zooniverse. While there are multiple disciplines from biology to art, to history, they all require users to organize photos collected by a research team. For example, in a project about pelicans, participants identify how many pelicans are in the photo, what actions they are performing, how many eggs are in the photo, and if there are any other animals. Each project could have hundreds of thousands of photos to classify, which is why the hundreds of citizen scientists on the platform are vital (Zooniverse, n.d.).

2.1.1 Data Collection

Data collection is when citizens actively collect data for the project. The easiest example of data collection is the observations found on the iNaturalist and iSpot websites. People take photos of plants and animals and upload them to the platform along with its location. This data helps scientists observe population distribution of thousands of species across the globe (iNaturalist, n.d.; iSpot, n.d.).

One project is the Christmas Bird Count, which is the oldest citizen science project in the world, having started in 1900. Every December to January, birdwatchers count bird species and submit their data to the National Audubon Society. The data from these counts has been used vital in recognizing the impacts of climate change because scientists can track changes in population size and distribution of over 500 bird species (National Audubon Society, n.d.).

2.1.3 Instrumentation

Instrumentation is a primarily passive type of citizen science where citizens don't actively gather or analyze data but rather host an instrument, or sensor, that records data. Often, the sensors record air pollution such as Cambridge University's CamPerS (Cambridge Personal Sensors). It is a wearable lightweight sensor that measures carbon monoxide (CO), nitric oxide (NO), and nitrogen dioxide (NO_2) (Jerrett et al., 2017). They are not limited to air pollution as Pandeya et al. (2020) developed a sensor that measures water level to mitigate flood risk.

2.2 Citizen Science Benefits

Citizen science brings three general benefits: increased research quantity, increased research quality, and citizen and community advancement (Den Broeder et al., 2018). The flow from type of citizen science to benefits is captured in Figure 2.1

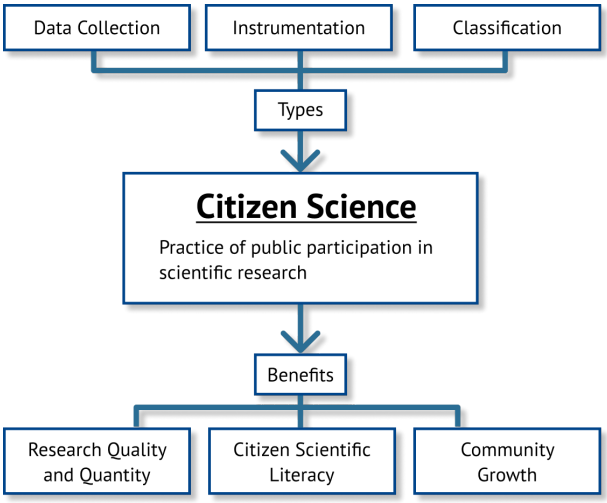

Figure 2.1 Citizen Science (infographic Flaherty, 2020).

2.2.1 Increased Quantity of Research

The participation of citizens means there are more people able to collect and analyze data and thus more research can be produced. This is especially important in research with large geographic and temporal scales (Dickinson et al., 2010). Some well-known global citizen science projects are the studies of butterfly and bird migrations. The North American Butterfly Association (NABA) has run the Butterfly Count Program in the United States, Canada, and Mexico since 1993. The data from these counts gets published into reports and informs scientists about geographic distribution and population size of butterfly species. Comparing data over data can give insight into weather and habitat change (NABA, n.d.).

2.2.2 Increased Quality of Research

Citizens increase the quality of the research by adding local knowledge that wouldn't be found in research literature, improving scientific knowledge and helping solve complex societal problems (Den Broeder, 2018). For example, local marine knowledge from regions across the world is "used to provide historical and contemporary baseline information, suggest stewardship techniques, improve conservation planning and practice, and to resolve management disputes" (Thornton and Maciejewski Scheer, 2012).

2.2.3 Citizen and Community Advancement

Finally, there are numerous benefits citizen science offers to citizens and their communities. Due to exposure of concepts such as the scientific method and rigorous collection of data, citizen science projects can increase scientific literacy in the community. Therefore, participants will be able to apply their new skills to scientific research and earn a new appreciation for science (Den Broeder, 2018). The local scientific awareness that is established

enhances social learning, social capital, and trust due to the participants' exposure to new skills and knowledge about the community (National Institute for Public Health and the Environment, n.d.). That new knowledge will inherently inform their opinions and decisions about local policy.

An example of individual and community benefits is in the Cat Tracker Project that took place in South Australia February 2015 to September 2016. The project consisted of two parts: an online survey and a period of tracking a select group of cats with a GPS. The online survey examined cat ownership, cat personality, attachment to cats, cat management, and participant demographics. The group that had their cats tracked, the citizen scientists, were the most impacted by the project and vowed to manage their cat's activity better. Additionally, survey responders that did not have their cats tracked, and people who did not participate at all, still learned better cat management practices (Roetman et al., 2018).

2.3 Citizen Science in Venice

Citizen science is rapidly growing in Venice. This section details the impact citizen science has on the community as well as the ongoing projects in Venice.

2.3.1 Research Into Citizen Science's Potential

The Venice International University (VIU), an international coalition of 20 universities, has a focus area called "Science Communication and Education" that specializes on public engagement and increasing knowledge and participation in science and research (Venice International University, n.d.). Ca' Foscari University in Venice, recently announced the Inclusive Science and European Democracies (ISEED) project. ISEED, an ambitious, multi-disciplinary project to analyze the role and value of citizen "participation in institutional decision-making that takes into account open, transparent, and shared access to deliberative process" as well as how to "improve participation and deliberation in democracy." The project will begin February 2021 (Ca' Foscari University of Venice, 2020b).

Venice also hosted the third international Citizen Observatories for Natural Hazards and Water Management (COWM) conference in September 2020, bringing representatives from research institutions, businesses, public agencies, and engineering companies together to discuss "water and soil resources management, natural risk management, and environmental protection" (COWM, n.d.). The goal of the 2020 conference was to explore citizen science's capability to increase resiliency in communities and protect cultural heritage (COWM, n.d.).

2.3.2 Citizen Science in Venice's Lagoon

Venice's culture and economy are primarily defined by its lagoon; the lifestyle and architecture has been built around the canals and countless art pieces have been inspired by its natural beauty (UNESCO, n.d.). Historically, the lagoon has played a vital role in the Venetian economy as an industrial center for shipbuilding, petrochemical processing, fertilizer and pesticide production, and non-ferrous metallurgical processing. Its location in the northern Adriatic Sea (as seen in Figure 2.2) grants it immense productivity as a port for exchanging goods even today. Over 120 fish farms fill the lagoon and over 80,000 farms for corn, cereal, and livestock occupy the drainage basin (Suman et al., 2005). The strong influence of the lagoon on Venice has caused "Venice and its lagoon" to be classified as a UNESCO World heritage site in 1987 (UNESCO, n.d.).

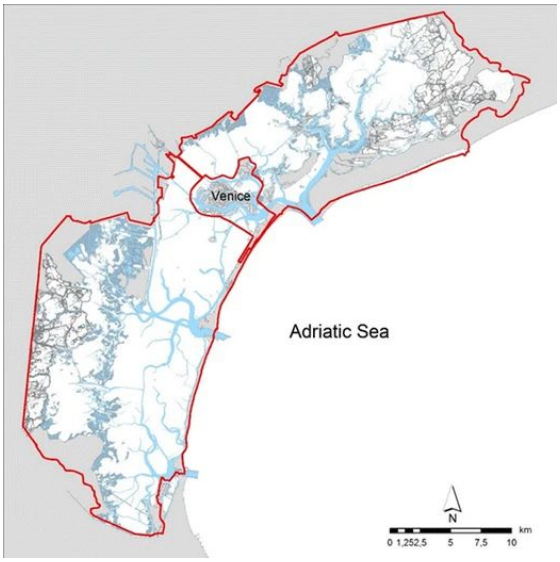

Figure 2.2. Venice and its lagoon (Scarton, 2017).

The biggest threats to the lagoon are humans, whether directly through pollution or indirectly by climate change. As such, most citizen science efforts within Venice concentrate on preservation and conservation of the lagoon and its ecosystem.

The PERSEUS Project is funded under the EU Seventh Framework Programme with the goal of protecting the seas. It hosts two citizen science projects - Jellyfish Spotting and LitterWatch, in which people submit photos and information about jellyfish or pollution observations (PERSEUS, n.d.). Stefano Piraino, a professor of zoology at the University of Salento, is among many researchers who use the PERSEUS project to enable their research. Piraino used Jellyfish Watch to detect a new species of jellyfish in the Gulf of Venice (Piraino, 2014). While such a discovery is incredibly exciting, Piraino and his team are also focused on the impact this new species will have on the native flora and fauna (Piraino, 2014). Without Jellyfish Watch, this new species would not have been located as quickly and could've caused severe damage to the lagoon ecosystem.

Our sponsor, Venice Calls, collaborates with numerous other Venetian local businesses and organizations to perform citizen science projects. One of the biggest projects they do is based around pollution in Venice. They bring the Venetian community together to host events like Blue Horizon Project, to spread awareness about plastic pollution in the lagoon. They also work with Plastic Free Venice Lagoon to organize large-scale clean ups and environmental monitoring initiatives in collaboration with research institutions (Plastic Free Venice Lagoon, n.d.; Venice Calls, n.d.).

Citizen science has even prevailed and provided new insights while affected by COVID-19. Venice's economy is heavily reliant on tourism, bringing around 3 billion Euros a year (Momogliano, 2020). To reduce the impact of COVID-19, the Italian government limited all non-essential travel on March 9, 2020 (France-Presse, 2020). This drastically reduced the traffic in the streets, as there were an estimated 87,300 tourists crowding Venice daily (Bertocchi and Visentin, 2019). Soon after, Venetians marveled as the canal waters were clearer than they have ever seen, and fish and birds flocked the lagoon (Moraca, 2020). Fabio Pranovi and his ecology

research team at the Ca' Foscari University called upon Venetians to send them any photos of the lagoon, animals, or state of the canals. Any submissions sent will guide the team on analyzing anthropogenic influence on the lagoon and ways to improve environment conditions in Venice (Ca' Foscari University of Venice, 2020a).

2.3.3 Efforts by Venice Calls

Our primary stakeholder is our sponsoring agency, Venice Calls. Venice Calls is a non-profit organization that has been working to solve environmental, social, and economic problems in Venice. The organization was founded in 2018 by a group of friends who all had the same intention in mind: to protect Venice and the Lagoon. The organization strives to act on their mission by organizing projects, conferences, and events. Some projects include clean-ups, where the organization and those who choose to participate, clean beaches and the Lagoon area to reduce the amount of plastic found in the sea and raise awareness of the issue, as shown in Figure 2.3 (Venice Calls, n.d.).

Figure 2.3 Venice Calls clean up project (Venice Calls, n.d.)

Venice Calls also runs projects known as “retakes” where they clean and remove graffiti from city building walls. The organization has worked with Masegni & Nizioleti, a Venetian association whose goal is to organize cleaning events and organize activities against the vandalism of buildings (Venice Calls, n.d.). Venice Calls’ newest initiative is the Public Green Program, which focuses on planting trees and plants in order to raise awareness of the lack of greenery within the city. However, due to the COVID-19 pandemic, it has been postponed indefinitely.

2.3.4 Efforts by WPI, the Venice Project Center

The Venice Project Center is a part of Worcester Polytechnic Institute’s (WPI) Interactive Qualifying Project (IQP) program. During it, students travel to communities across the globe and work with those communities on a local problem. The Venice Project Center has been hosting projects since 1988 across a variety of subjects. Past projects include:

- “Created a digital model of Venice streets, conducting pedestrian counts to identify congestion points
- Designed a smartphone game exploring displaced artwork, demolished churches, and filled-in canals of Venice
- Built a proposal for tourism management based on safety and occupancy standards” (Worcester Polytechnic Institute, n.d.)

In 2019, in collaboration with Venice Calls, WPI students completed the "Plastic-Free Venice: Quantifying and Mapping Plastic Pollution" project in which they collected, categorized, and weighed pollution in the Venice Lagoon. They also assessed the effectiveness of public trash receptacles and waste pick-up locations so they could finally "develop recommendations for the overall plan to reduce plastic pollution" (Bonnano et al., 2019).

2.4 Enhancing Communication Between Science and the Community

Citizen science enhances social learning, social capital, and trust due to the participants' exposure to new skills and knowledge about the community (National Institute for Public Health and the Environment, n.d.). That new knowledge will inherently inform their opinions and decisions about local policy which pervade throughout the community (Roetman et al., 2018). Thus, it is essential that citizen science data is clearly communicated to the community. Data visualizations can be used to enhance data comprehension (Taylor, 2016).

2.4.1 Emergence of Citizen Science Platforms

Advancements in technology have encouraged organizations to develop citizen science web platforms. These platforms have the potential to be immensely powerful resources to many different stakeholders: the public, journalists, other researchers, government officials, and more. Four ways citizen science web platforms are advantageous are:

1. Increase ease of communication within communities, and possibly change the boundaries of effective community formation (Leeuwis et al., 2018)
2. Act as a resource for citizens to learn about a topic and participate in researching it (Leeuwis et al., 2018)
3. Support the co-creation of relevant knowledge by making community-based monitoring part of citizen science activities that add value to available information Leeuwis et al., 2018)
4. Strengthen the ability of local communities to organize via connective action, which constitutes a new form of collective mobilization that is less reliant on formal organizational coordination (Leeuwis et al., 2018)

An example of a citizen science platform is SciStarter, which offers more than 3,000 projects to join where participants can collect or analyze data (Scistarter.org, n.d.). There are also free mobile apps available, such as iNaturalist, in which participants can share pictures of wildlife and nature of their region (iNaturalist, n.d.). This increase in citizen science applications being hosted on online platforms is the result of enabling projects to have many participants interact simultaneously. Not only does it allow for a larger amount of contribution, but it also provides an inherent way of advertising the project to prospective participants.

2.4.2 The Importance of Data Visualizations in Science Communication

Data visualizations enable quick comprehension of aggregate data. Without accurately and responsibly visualizing the data, stakeholders could misinterpret the data and make misinformed decisions. Therefore, it's important our design provides clear communication about ongoing efforts in Venice backed up by straightforward and reliable graphs and charts. Data visualizations expedite information processing by displaying information in a format the human brain can process quickly.

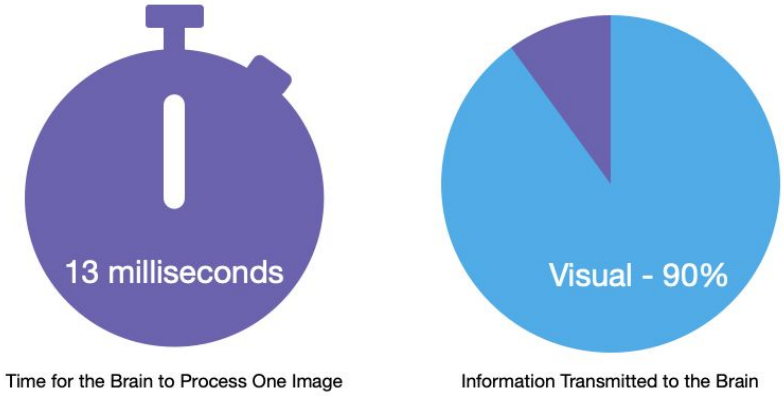

Figure 2.4 Graphical representations of the information in 2.4.2 (data from Trafton, 2014; visuals by Davis, 2020).

The human brain can process an image in as little as 13 milliseconds (Trafton, 2014). For context, a blink of the human eye takes approximately ⅓ of a second, or 333 milliseconds (Kwon et al., 2013). That makes visual information the fastest type of information a human can understand and hence why most information is presented visually. An example of visualizations aiding the speed of comprehension can be found in Figure 2.4

3. The Process To Produce The Design

The goal of this project was to develop a design of a digital platform for citizen science projects in order to address environmental, social, and economic problems in Venice. To design the platform, we followed the following design process:

1. Identify potential user identities and preferences
2. Adopt and adapt features from existing platforms
3. Iteratively design the citizen science platform

The subsequent sections describe the strategies we used to achieve each of the deliverables. These deliverables were followed through an iterative process, constantly being revisited throughout the duration of the project.

3.1 User Identities and Features of the Citizen Science Platform

To understand the goal and features of the platform, we first identified the types of users that could be using it through discussions with Venice Calls and our advisors. For the list of questions we asked to each entity please refer to Appendix C, D, and E. Then, for each user, we created detailed user profiles that described their occupation, purpose of using the platform, and preferences (Farino, 2013). The types of users we identified the following (Figure 3.1.1):

1. Organizers
2. Volunteers
3. Scientists
4. Journalists
5. Non-Volunteers/Citizens

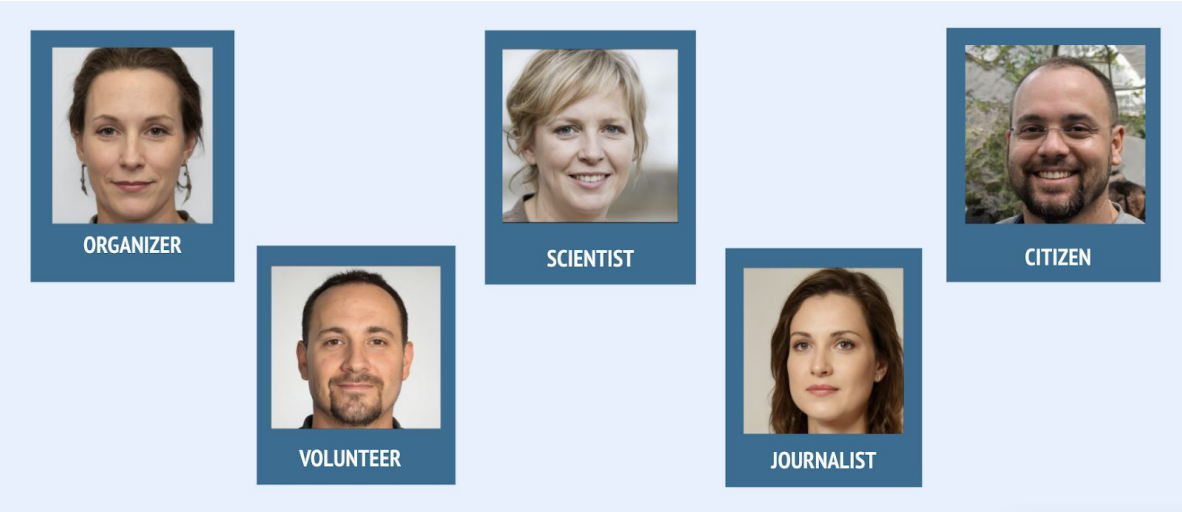

Figure 3.1.1. Headshots for User Profiles

The next step was to identify what each of these identities' motivation for using the platform could be. We identified the features they wished were in existing platforms and how they would use them. From the features that the potential users would want, we developed a list of features the design of the platform should have. Throughout the duration of the project, we revisited this deliverable to make sure our design addressed the wants and needs of our potential

users. Our main features, as seen in Figure 3.1.2, revolve around the citizen science projects that would be hosted on our platform. From these core four features, we designed elements of the website that would aid users in locating and using these features.

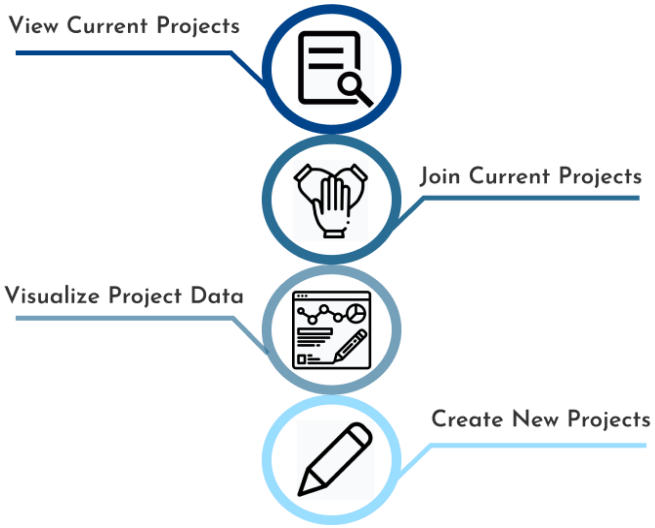

Figure 3.1.2 Main Features of the Platform

3.2 Adapt and Adopt Features from Existing Platforms

The second step in our iterative design process was to analyze existing citizen science platforms to adapt and adopt the user interface (UI) and user experience (UX) elements of their platforms.

User interface is associated with visual elements, such as buttons and icons, that allow a user to interact with a product or service, or in our case, an online application (Digital.gov, n.d.). A seamless UI is essential for citizen science platforms to maximize user engagement and increase their likelihood of returning to the platform. Therefore, we conducted participant observations by analyzing twelve web platforms and ranking their features in a matrix as seen in Appendix A. After analyzing these platforms, we combined our rankings to focus on the most important features. The platforms with the top three scores, as seen in Appendix B, are listed below:

1. Zooniverse
2. EU-Citizen Data (tie)
2. iNaturalist (tie)
3. ALA Project Finder (tie)
3. Anecdata (tie)
3. CitSci (tie)

The best user interface elements were screenshotted and annotated with detailed labels to identify how and why we should implement them into our application. This can be seen in Figure 3.2.1.

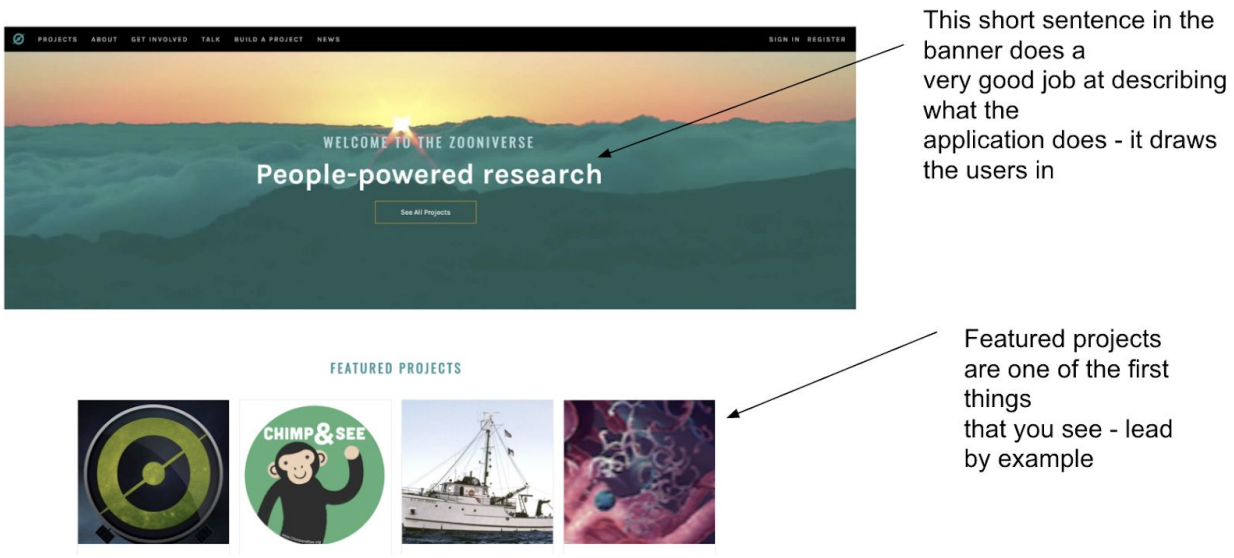

Figure 3.2.1 Annotation of Zooniverse

3.3 Iteratively design the citizen science platform

To design our online platform, we used Figma, an online collaborative application to design various user interfaces. Its easy-to-use interface and ability to create prototypes helped us share our designs with the stakeholders to solicit feedback and to evaluate the effectiveness of our designs. We also used Figma to gather features and user interface elements from various other websites and organize what aspects we like and want to incorporate into our design. By using Figma, the resulting product is a comprehensive and interactive design that clearly lays out how the website should function and look.

Once the design had been completed, we moved on to the next step of the Iterative Design Process, which involves designing layouts, connecting them together into a prototype, and then evaluating the prototype with the goal of improving the design. For the evaluation, we consulted our advisors, sponsor, and peers and they tested the design prototype. Their feedback informed us on aspects of the design that were missed or needed improvement.

4. The Venice Citizen Science Website

Using Figma we were able to design a website that met the needs of the users we identified. In order to efficiently describe the important features of our design, we will walk through each user profile to discuss how each type of user would use the platform. To view all prepared views of the website please reference Appendix F, G, and H or our website; sites.google.com/view/ve20-vcsp

The overall organization of the platform, as seen in Figure 4.0.1, consists of multiple organizations that host citizen science projects. For each project, there can be multiple events. Each event has information on where and how to participate, and the data that was collected during that event. The events, project descriptions, images, data sets, and data visualizations for each organization can be changed at any time by an organizer.

Figure 4.0.1 The Conceptual Organization of the Platform

4.1 Organizer

The primary users of our platform will be the organizers of the citizen science projects. These users represent local organizations who sponsor citizen science projects. We created a user profile for organizers, as it can be seen in Figure 4.1.1.

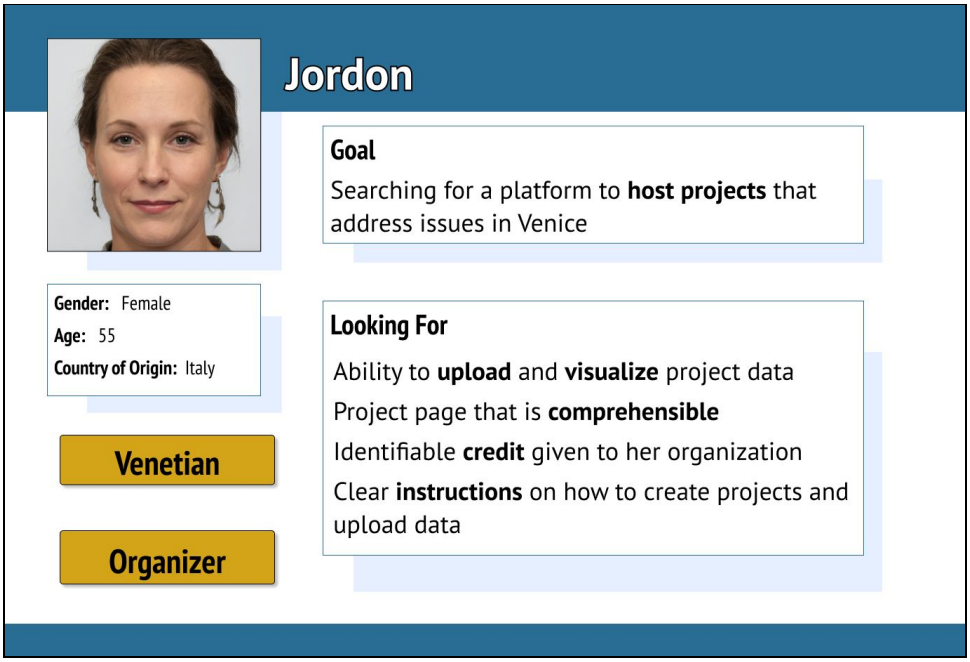

Figure 4.1.1 Organizer User Profile

An organizer would use the platform to publish their projects in order to attract volunteers. They would also want to visualize data obtained from the projects. Accomplishing these tasks require complex tools, thus the organizer needs the platform to have clear instructions and an intuitive design. Finally, an organizer would want all platform users to be able to view and contact their organization.

In our platform we include an organization page, as seen in Figure 4.1.2, where organizers like Jordan can publicize their organization's mission, contact information, and citizen science projects that they are hosting. When an organizer is logged in, they can change the content of the page and add new citizen science projects whenever they want. The process to add a project is made easier by outlining steps that provide assistance with what each section should contain.

Figure 4.1.2 Organization Page

Once the organizer has created a new project, they can edit the project to provide graphics, descriptions of the project, contact information, as well as information on how to take part in a project and its events. This editing view of projects and events can be seen in Figure 4.1.3.

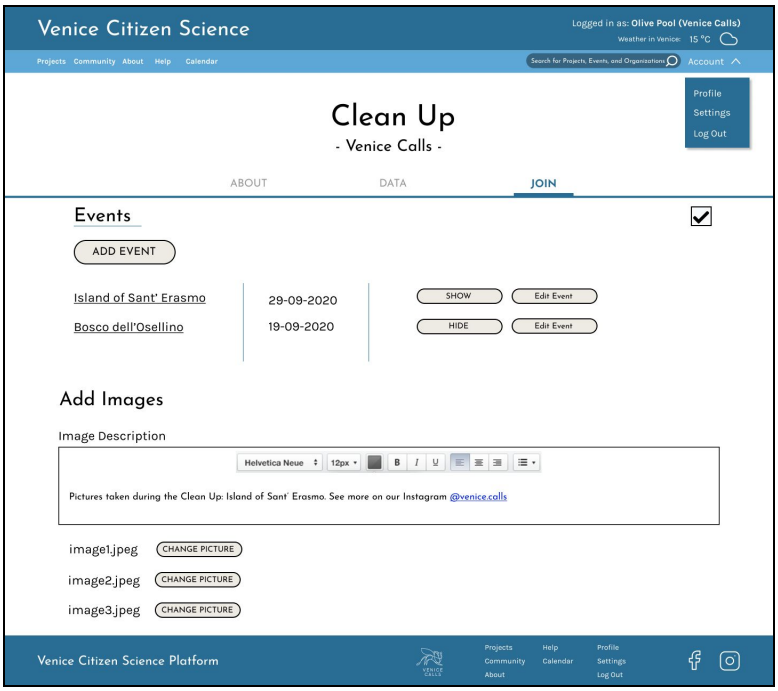

Figure 4.1.3 Editing Project Page

An organizer can also upload data for a project or a project's event. From their point of view, the data section of a project or event page allows them to filter through already existing data sets and data visualizations, but also upload their own data to the platform. This interface can be seen in Figure 4.1.4.

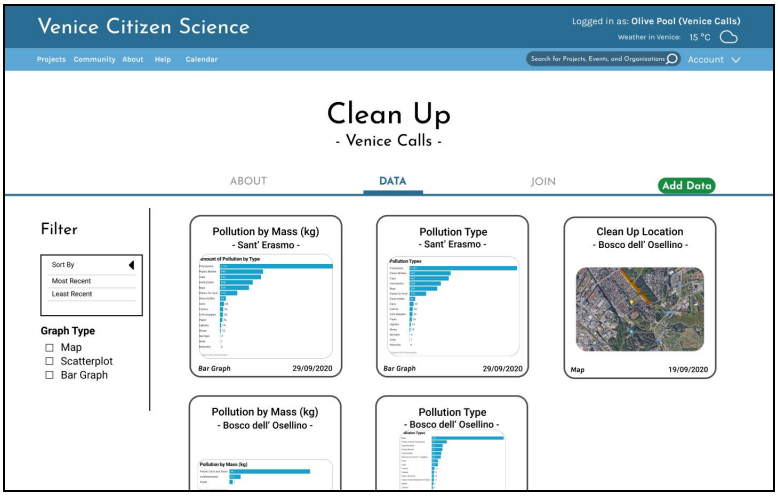

Figure 4.1.4 Data Tab from Organizer's Perspective

4.2 Volunteer

Our second type of user is the volunteer. Without them, we wouldn't have abundant amounts of data to collect and share. We created a user profile to provide an example of who a volunteer who uses our platform could be like. The information regarding our volunteer, Phil, is displayed in Figure 4.2.1.

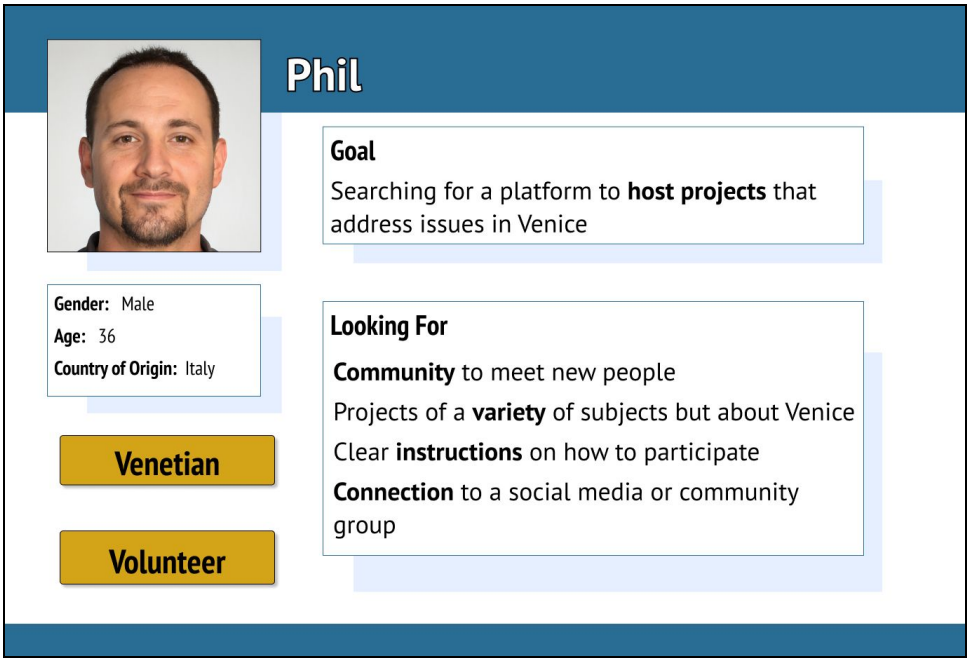

Figure 4.2.1 The Volunteer User Profile

Volunteers want to learn more about the organizations that host citizen science projects and how to get involved in their projects. In addition, volunteers may be looking for a community to meet new people.

Volunteers can click on the Projects tab to find citizen science projects that they may be interested in participating in. They will then arrive at the projects page, as seen in Figure 4.2.2.

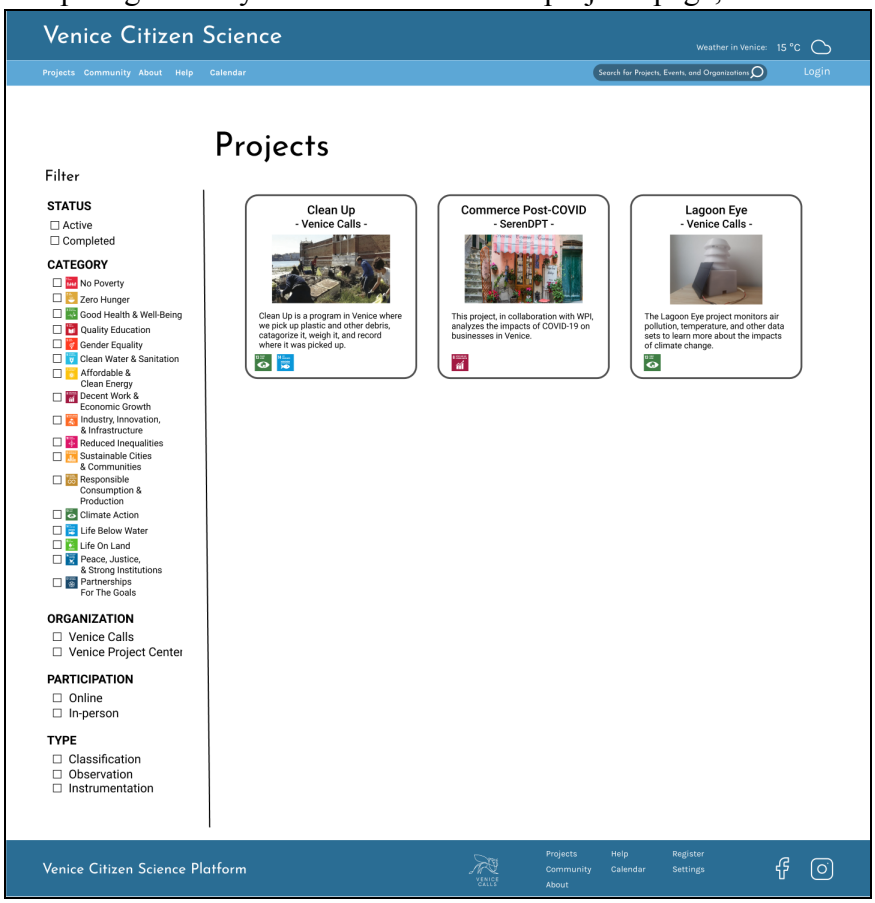

Figure 4.2.2 Projects Page

On the projects page, volunteers have many options to find a project that they deem interesting. One of the tools they could use is the filter section on the left hand side of the screen. The filter allows for users to view projects by: status of the project, United Nations Sustainability goal, sponsoring organization, type of participation, and type of citizen science project. By using the filter, volunteers can find specific projects that align with their interests. Each project has a brief description. Users can also get a glimpse of what the project is about by looking at the thumbnail picture and the associated United Nations Sustainability Goal.

Once the volunteer has found a project that they are interested in, they can click on it to arrive at the project's About page. We'll discuss the about page more in the section 4.4 Journalists and Citizens. To learn more about the organization hosting the project, users can click on the organization name. To learn how to participate in this project, volunteers can click on the Join button, as seen in Figure 4.2.3.

Figure 4.2.3 Join section of the Project Page

Volunteers can participate in events the project is hosting. The events are displayed in a grid-like format with a title and picture of the event. For example, the Clean Up project has an event called "Island of Sant' Erasmo", where participants will be picking up plastic and sorting it based on its type and weight.

If a volunteer sees an event that they are interested in joining, they can click on the event and be led to the event's Join page, as seen in Figure 4.2.4. There, users can see when and where the event will take place, what kind of gear is required, how to sign up, and who to contact with questions. To get directions to the meeting location, clicking on the map will direct users to a Google Maps page where they can get personalized directions to the event.

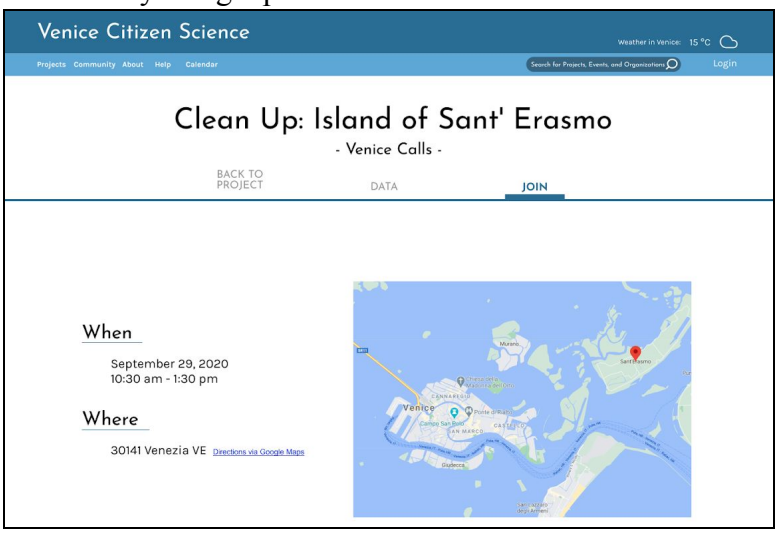

Figure 4.2.4 Join section for an Event

If the organization is not hosting events, users can scroll down on the project's join page to learn more about other ways to participate in the project, as seen in Figure 4.2.5. Users can also join the project's newsletter to be kept up to date about the progress of the project and to learn new ways that they can get involved.

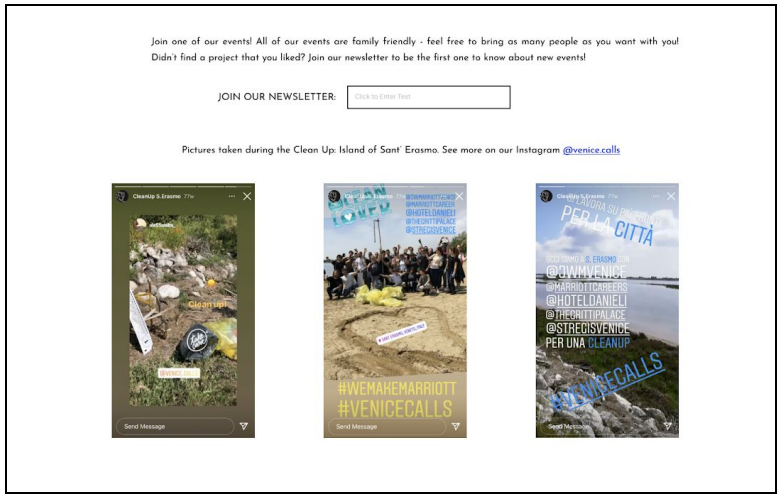

Figure 4.2.5 Join Section with Newsletter option

4.3 Scientists and Government Officials

The next types of users are scientists and government officials. We grouped them together because they have similar motives when navigating our platform. Both of these types of users want access to raw data and view the methods of data collection used by specific projects. Scientists want to look at the raw data on our platform in order to help them with their own projects or research. Government officials want to look at data and view projects in order to share accurate information with the public. We created a user profile for a scientist, as seen in Figure 4.3.1.

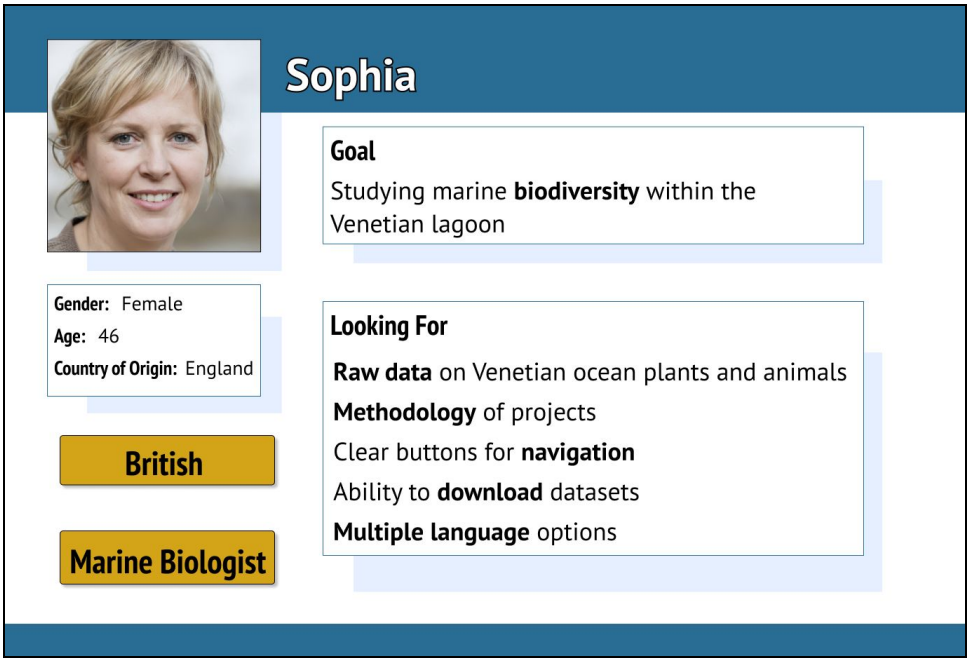

Figure 4.3.1. Scientist User Profile

When using the application, scientists will look at projects related to their field and spend most of their time in the “Data” tab of the events page as seen in Figure 4.3.2.

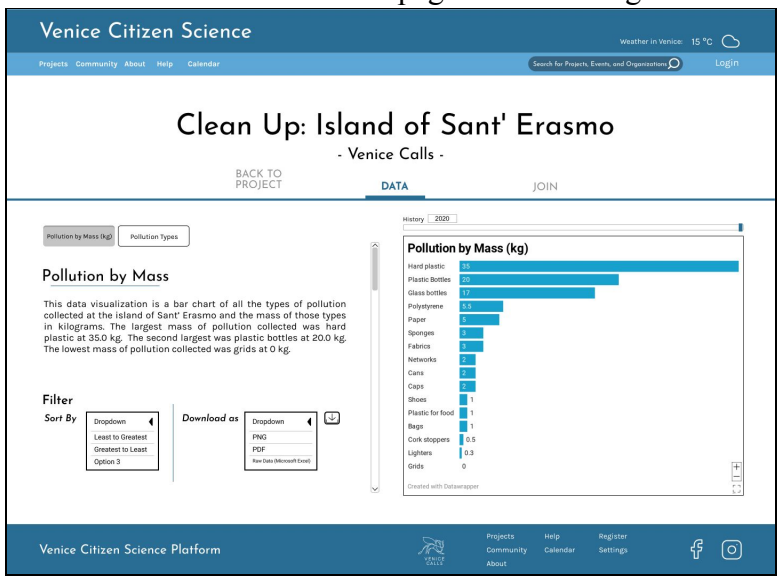

Figure 4.3.2. Data View and Download Page

At the top of the left section of the page, users can toggle through each data set and get a description, accompanying visual, and options to download the data. After selecting a data set, users can filter the data they want to see in the visual or download the raw data to create their own data visualizations.

4.4 Journalists and Citizens

Our final two types of users are journalists and citizens. Because they share similar user journeys and preferences, they will be discussed in the same section. Their user profiles can be seen in Figure 4.4.1 and Figure 4.4.2 respectively.

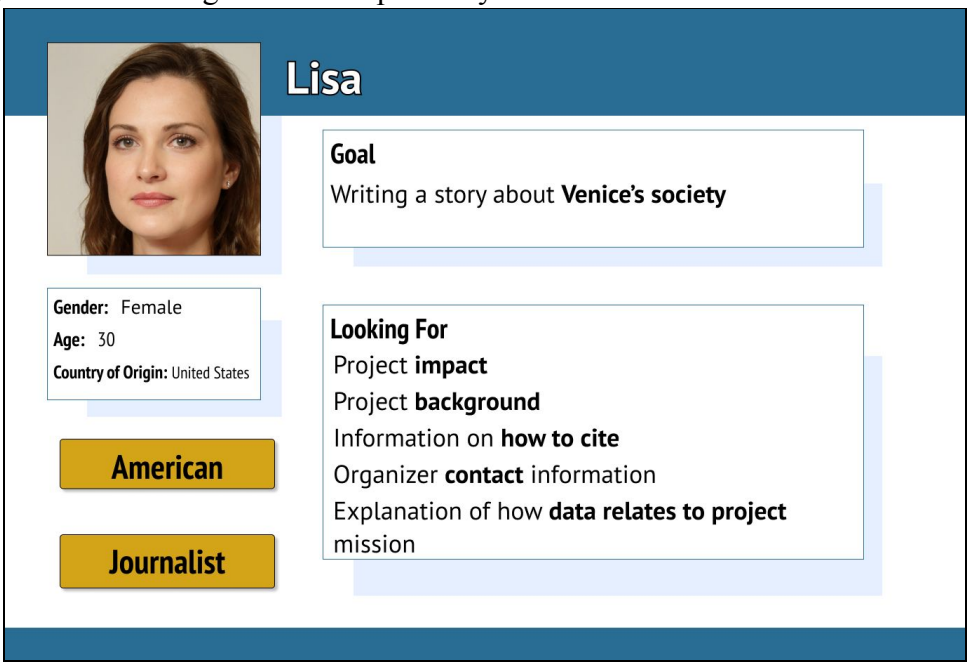

Figure 4.4.1 Journalist User Profile

A journalist would be interested in learning about the citizen science projects and the impact they have on the Venitian community. If they wanted to cite the information they obtained from the platform, they would like to know how to cite the information. In addition, if they want to interview the organizers of the projects, they would like to have access to their contact information.

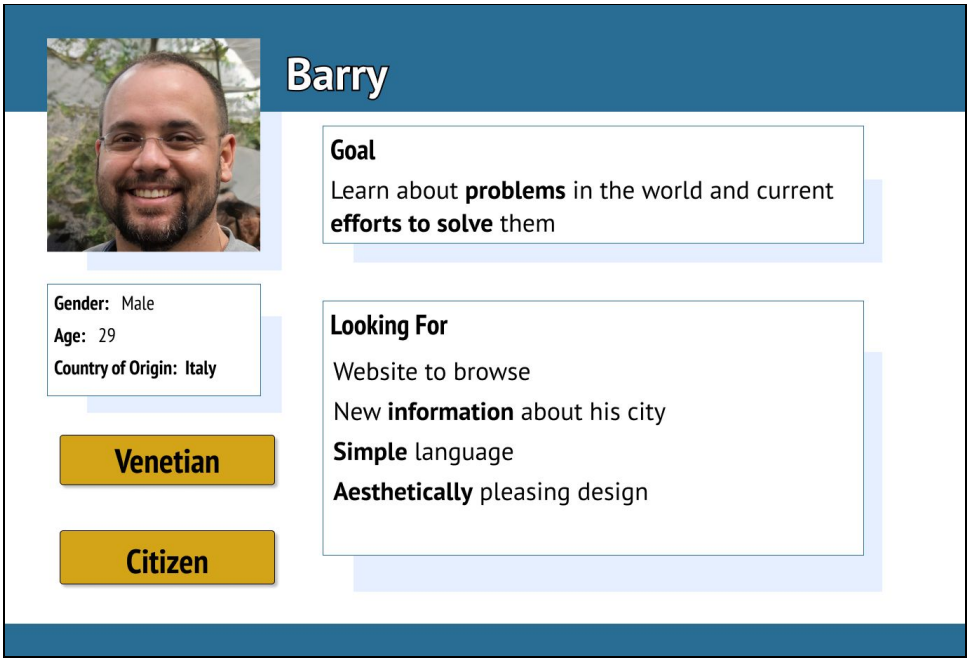

Figure 4.4.2 Citizen User Profile

A Venetian citizen would be looking to learn more about how issues in their city and the world are being addressed. They would mainly be browsing through the platform and the current projects for their pleasure and would want to learn more about the platform's goal, how the platform is accomplishing that goal, and the history of the site.

When general visitors first reach the platform they will be greeted by the home page (Figure 4.4.3). At the top of the home page is a banner image, which shows Venetians participating in citizen science projects, and is accompanied by a short description of the platform. The description welcomes the visitors and has a call to action to interact and participate. Below the banner image are a few featured projects, these highlight the wide array of opportunities available on the platform. Further below is the platform's mission and a visual of the main features the platform offers.

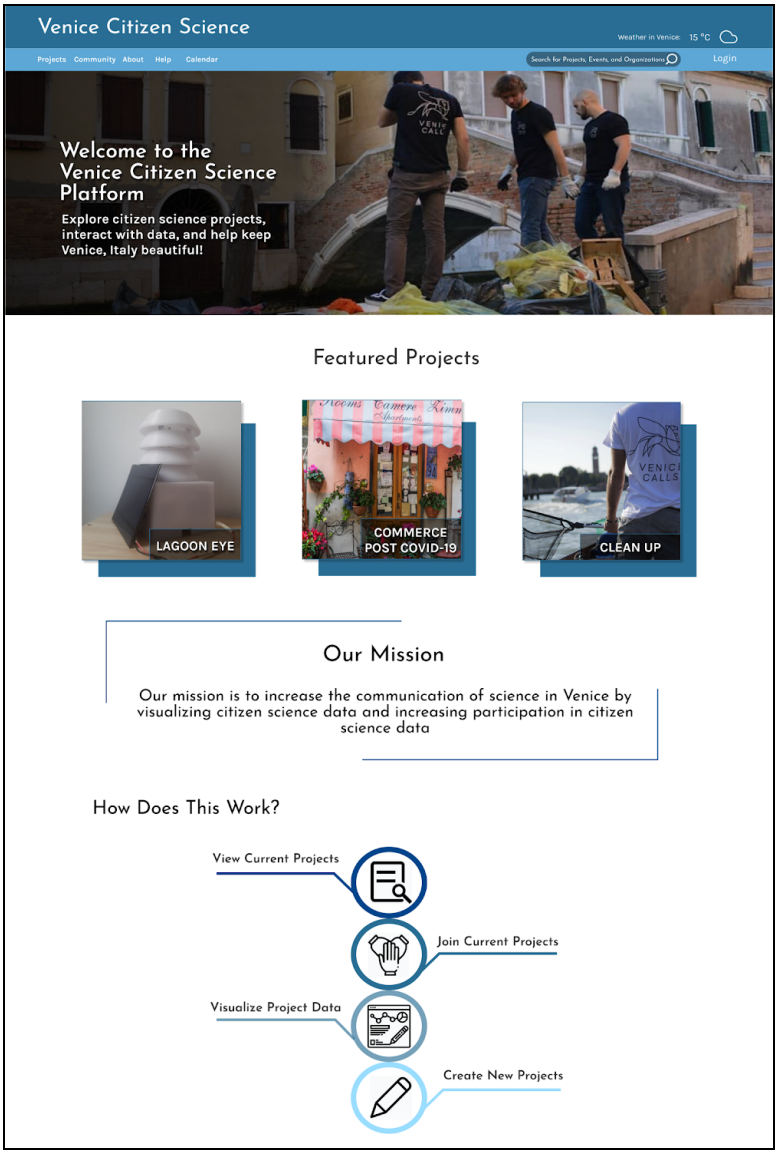

Figure 4.4.3. The homepage of the platform

In addition to the homepage, there is more information on the About page describing how the platform works and how projects relate to the UN Sustainability Goals.

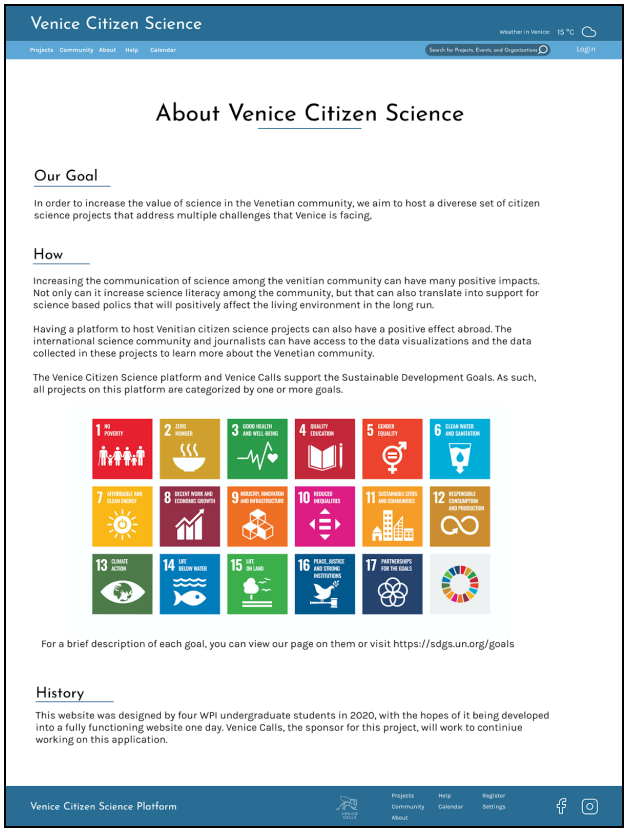

Figure 4.4.4. About page of platform

Once users are familiar with the platform, they can begin exploring projects. After selecting one, they are able to view the goal of the project, its impact thus far (seen in Figure 4.4.5), and contact information for the project's organizer(s). For more information about the sponsoring organization, users can click on the name of the organization, which is located under the project's title, and be taken to the organizer page (Figure 4.4.6).

Figure 4.4.5. About and apparent location of project organizer on project page.

Users can read the organization's mission and see what other projects they are sponsoring. Contact information for the organization is also easily accessible on the left side under the organization's cover image.

Figure 4.4.6. Mission and contact information on the organizer page.

Once the journalist has collected all needed information from the platform, they may want to know how to cite it. Selecting the "Help" button on the menu bar displays the platform's help page and located near the top are citation instructions (Figure 4.4.7).

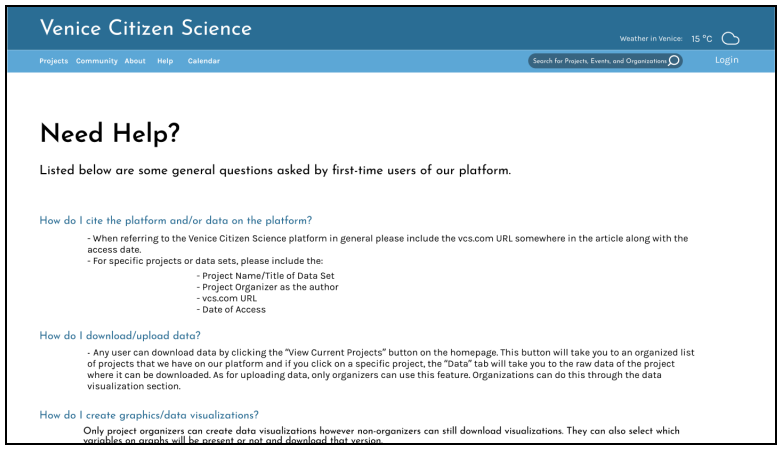

Figure 4.4.7. Information on how to cite the platform.

5. Concluding Thoughts On The Design

The one feature every user will use is the **homepage**. Because it will be seen by everyone, it is important to ensure the homepage is **straightforward, easy to navigate**, and aesthetically pleasing. Our design has a banner image at the top of the page welcoming users to the platform and giving them a preview of what the platform is about. Right underneath, a select few projects are featured so users are quickly introduced to the amazing projects this platform has to offer. Next, the mission of the platform is stated, to help anyone who is still unsure what the platform is for. Finally, the homepage has an interactive graphic with four buttons; View Current Projects, Join Current Projects, Visualize Project Data, and Create New Projects.

Second to the homepage, the **Help and Get Involved Pages** answer questions and offer guidance for all types of users. These pages help users learn more about how the platform works and how to get involved. The "Help" page answers some common questions asked by first-time users. Some of these questions are "How do I cite the website as a source?" and "How do I download/upload data?" The "Get Involved" page further explains how each type of user can get involved using our site. It explains what organizations, journalists, volunteers, scientists, government officials, and even what normal citizens can do to further make use of the site. We feel that these pages are important for **ensuring users clearly understand how to use the platform**.

The **project discovery page** is integral to the success of the platform. It provides easy access to all projects happening in Venice. Users can easily find the project they want with sort and filter options to best suit their preferences.

The motivation for this project was to **provide better access to citizen science data** and the data visualization pages provide that access. Users can easily visualize data and can download their visualizations for future use. Additionally, users can **get access to raw data** for any project.

To summarize, there are plenty of features that make this platform great. These are just several of the many features that we included in the platform design. We hope these features inspire users to return to the platform. Next, we are giving our design to our sponsor, Venice Calls, to **develop into a fully functionable website**.

6. Recommendations for Future Development

The design laid out in this report sets the course for developing a robust platform to support the various citizen science efforts occurring in Venice, Italy. Throughout this project we have gathered ideas, suggestions, and research on how to successfully implement this platform. In this section we will detail what we've learned and what decisions still need to be made.

6.1 Data Visualizations

Data visualizations were the central idea that spurred this project into existence. Our sponsor has a deep desire to share the data they are collecting in a way that can further scientific research and establish credibility of their collection methods. In order to implement data visualizations in this platform, three processes need to be considered:

1. The process by which data is stored
2. The process by which graphs and figures are created
3. The process by which data is downloaded (in bulk) and cited

Data is uploaded in three primary ways; in bulk by organizers, individually by volunteers, or semi-continuously by automatic sensors. The organizers will want to be able to upload their data as a document, primarily Excel Workbook, CSV, or as JSON. For them, the platform needs to be able to **receive uploaded files** and securely parse them in order to **save the data in a database**. The volunteers will want to upload data through the website directly, most likely on their phone. It will be important for the mobile version to contain a page making it easy to submit data to a project. The sensors will need to talk to the platform directly, with little to no human interaction. This is most securely accomplished by implementing an Application Programming Interface (API). The API handles the communication between the website/sensors and the database, ensuring the connections are secure (authenticated) and safe (non-malicious). Further research is needed to successfully implement a secure and safe API.

Graphs can be created using a multitude of software and services. The trouble comes when looking for the best software or service for the situation. During the course of designing the platform, we identified two solutions for creating visuals and embedding them in the platform. The first, and easier, method is to have users make an account on datawrapper.de and get embed codes after using Datawrapper's visuals utility. The second, and more seamless, method is to develop a visuals creation utility using **D3.js**, a popular JavaScript library for manipulating data and creating graphics. More research is warranted as well as consideration of the time and other constraints put on the development team.

Sharing data is the next step after storing and visualizing it. Various entities will want to be able to download graphs as well as the raw data for independent analysis. While only one option for downloading the raw data is necessary, supporting several file types to download makes it easier for users. We recommend supporting **excel workbook files** at a minimum. Additional file types may include CSV and JSON. In addition to downloading the data, users and organizers will want an easy way to cite the data they are using. Having a citation generator as

part of the download screen would make the process easier. More research is needed to discover if such generators exist already.

6.2 User Engagement

Visitor/user engagement is highly important for the success of this platform. Without users there is no point to creating a platform in the first place. It's important to continually grow the platform's audience of users as well as maintain engagement with those users who are already established.

- SEO
- Newsletters
- Accessibility

In order to **bring new users to the platform**, optimizing it for **search engines** is critical. Ensuring the search engine can retrieve useful information from the platform will help raise the ranking of the platform in users' search results.

In order to **maintain current users**, we will email a periodic **newsletter** with updates to the platform and its projects. The newsletter can contain information on how to get involved, and the benefits of being involved. This is also an opportunity to prey on the 'fear of missing out' complex, to entice users into participating.

Another key aspect of user engagement is **accessibility**. When developing web applications, the end goal is to have the application used by as many people as possible. With that goal in mind, it is crucial to accommodate as many users as possible. Users with impairments may have a harder time interacting with a website if their situation is not considered during the design of the application. Therefore, we recommend referring to the **W3C Web Content Accessibility Guidelines** to understand accessibility, usability, and inclusion principles and how people with disabilities use the web. Following those guidelines will help to ensure the platform is accessible to as many users as possible.

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Appendices

Appendix A - Platform Comparison Rubric

Platform Name	Targeted Purpose	Helpful Features (List most helpful (top) to least helpful (bottom))	Explain why you found the features helpful	UnHelpful Features (List least helpful (top) to more helpful (bottom))	Explain why you found the features unhelpful	Ease of use (1-10, 1: not easy, confusing, got lost. 10: Super easy, clear instructions, never lost)	Explain how the platform was or was not easy to use	General Comments
EU-Citizen Science								
CitSci								
Anecdata								
iNaturalist								
iSpot								
Zooniverse								
ALA Project Finder								
Venice Project Center								
Minna-no Data								
Österreich forscht - Citizen Science Network Austria (CSNA).								
Cape Citizen Science								

Appendix B - Scores of Citizen Science Projects -

Platform Name	Ease of use (1-10, 1: not easy, confusing, got lost. 10: Super easy, clear instructions, never lost)	Ease of use (1-10, 1: not easy, confusing, got lost. 10: Super easy, clear instructions, never lost)	Ease of use (1-10, 1: not easy, confusing, got lost. 10: Super easy, clear instructions, never lost)	Ease of use (1-10, 1: not easy, confusing, got lost. 10: Super easy, clear instructions, never lost)	Sum Of Scores
EU-Citizen Science	8	9	9	6	32
CitSci	6	10	7	8	31
Anecdata	7	7	10	7	31
iNaturalist	7	10	5	10	32
iSpot	6.5	7	6	9	28.5
Zooniverse	9	10	6	10	35
ALA Project Finder	9	7	8	7	31
Minna-no Data	7	6	7	5	25
Österreich forscht - Citizen Science Network Austria (CSNA).	8	5	9	10	32
Cape Citizen Science	8	4	8	8	28
European Citizen Science Association	9	7	7	9	32
Venice Project Center	9	8	9	5	31

Appendix C - Interview Questions for Professor DeWinter

1. Do you have any experience with crowdsourcing platforms?
    a. If No, switch questions to about data visualization platforms
2. [If Yes to Question 1]: What features are key in a (crowdsourcing) platform?
3. [Following Question 2]: What are the best methods of implementing these features?
4. [Following Question 3]: Can you link us to some examples you love?
5. [Following Question 4]: What are common mistakes made with these platforms?
6. How do we get a sense of Venetian cultural designs?
7. How should we approach making user profiles and journeys?

Appendix D - Interview Questions for Venice Calls

1. How many citizen science projects have you run? (to organizations)
2. What went well, what did not go well?
3. What kinds of feedback have you gotten?
4. Who do you want to use your site?
5. What organization has a model that you think is really good?
6. What kinds of methods did you find attracted the most volunteers?
7. How did you spread the word of your project?

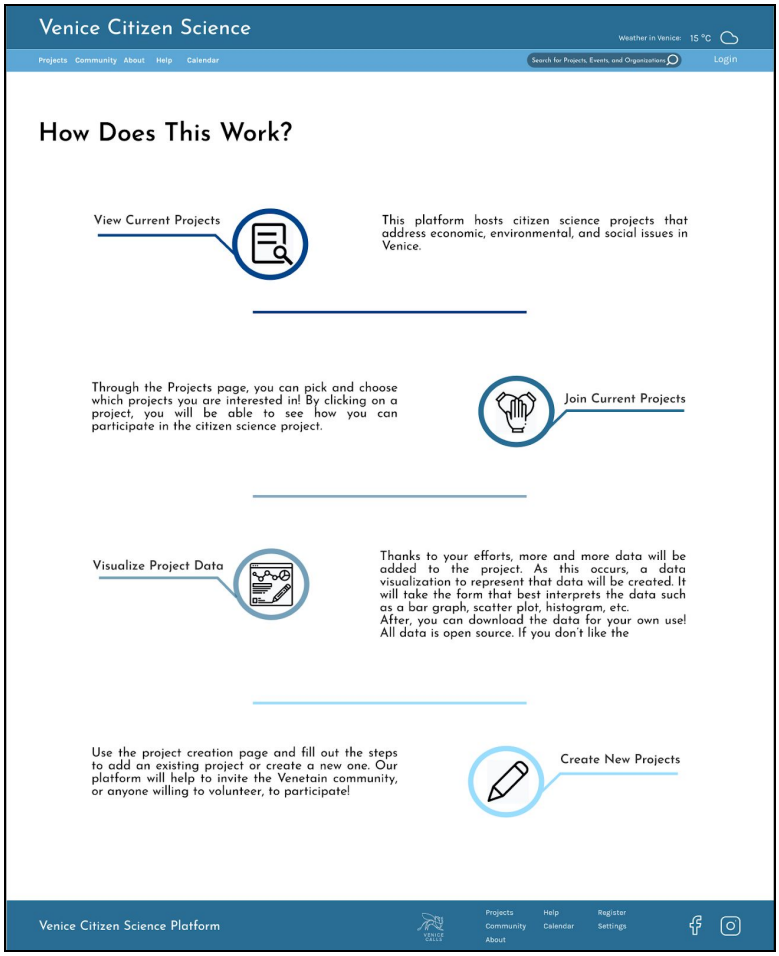
Appendix E - Interview Questions for Professor Harrison

1. What are the best data visualization options?
2. How can we import data visualization options into our platform?
3. What are the strengths and limitations of data visualization?
4. What is the right balance of text and imagery to convey information?
5. How can we limit bias from our data visualizations?
6. Do visualizations across different age groups need to be different? How?
7. What are some resources we can follow to ensure our graphs follow industry standards or best practices?

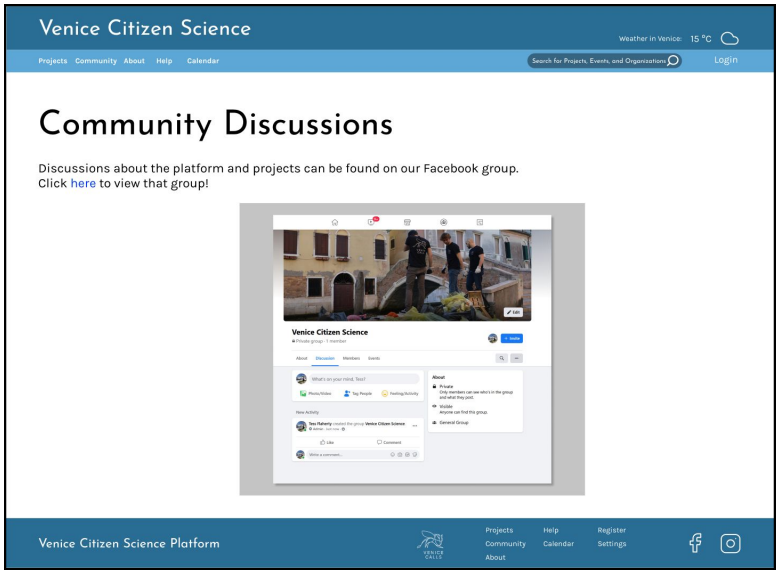
Appendix F - The Application: Visitor View

The Home Page

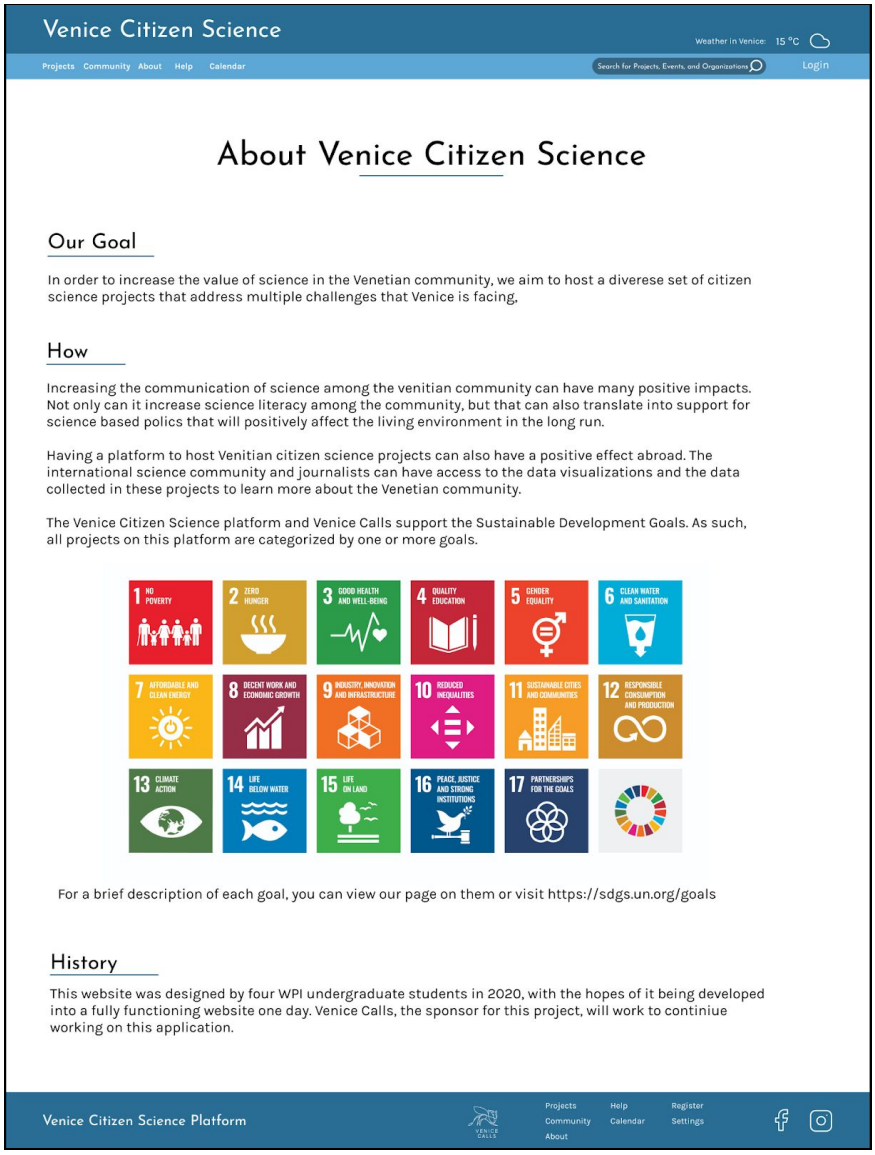
“How Does This Work?” Page



Community Discussions Page



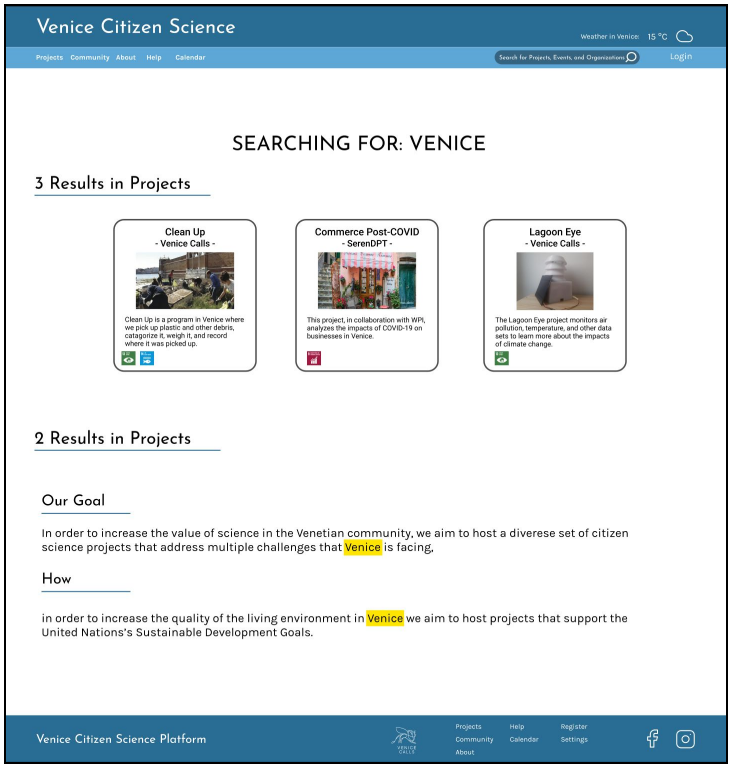
About Venice Citizen Science Platform Page



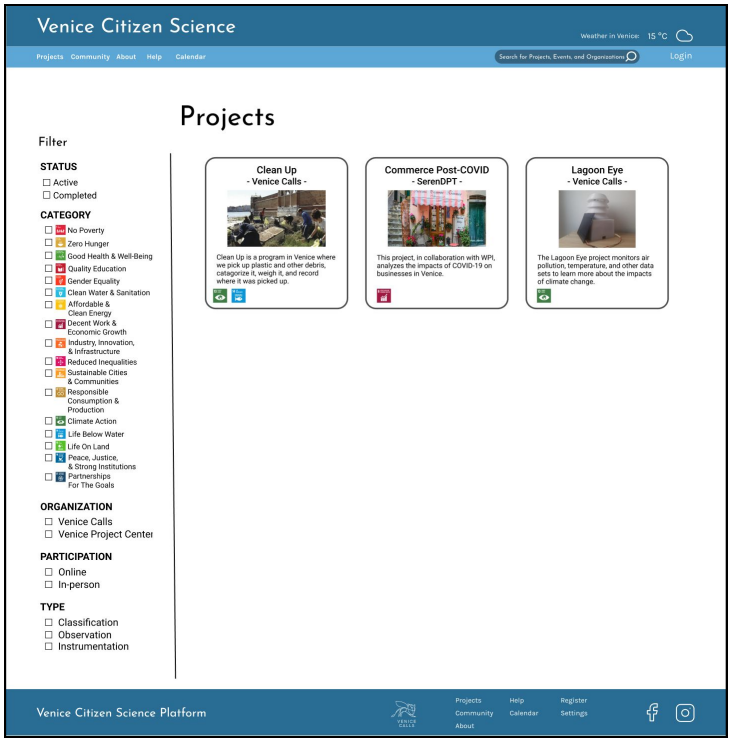
Sustainable Development Goals Page

Calendar Page

Search Results Page

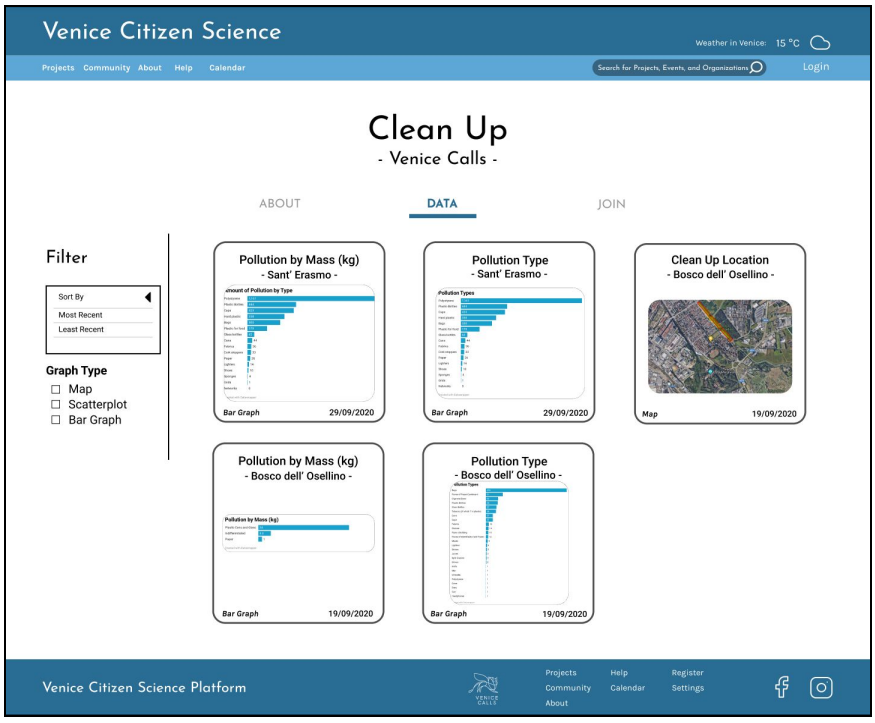


Explore Projects Page



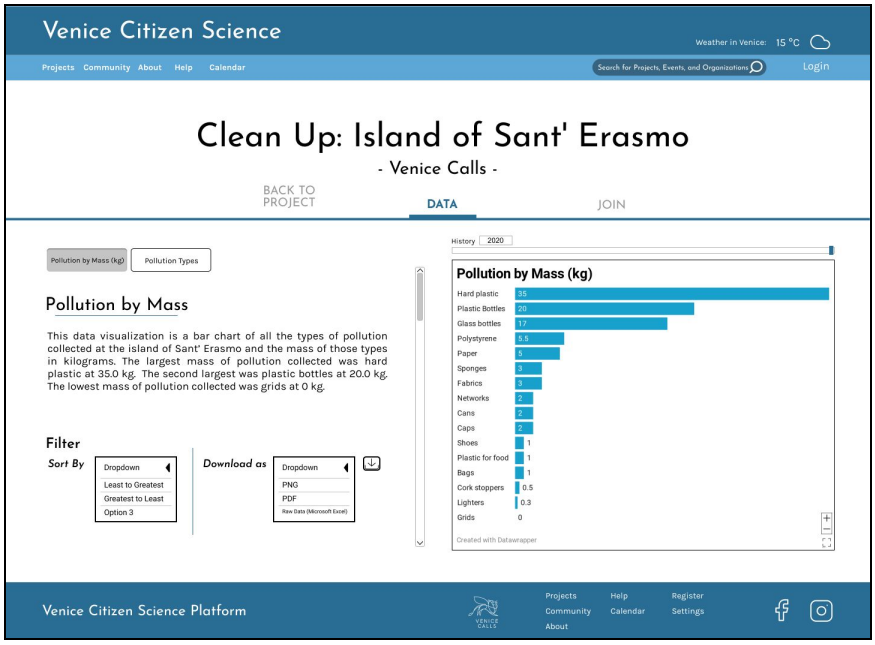
Project “Clean Up” About Page

Project “Clean Up” Data Page

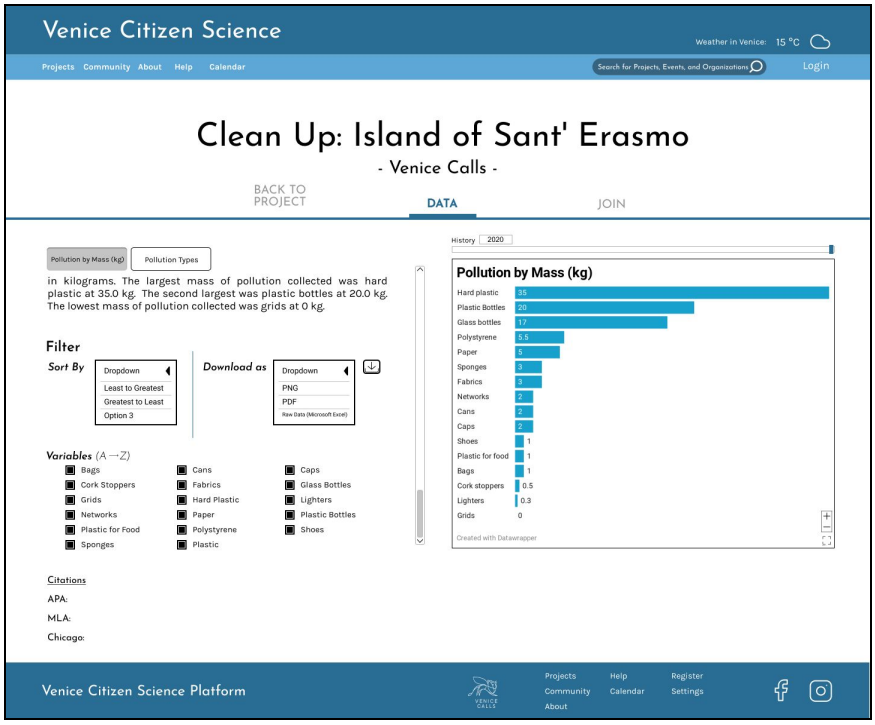


Project “Clean Up” Join Page

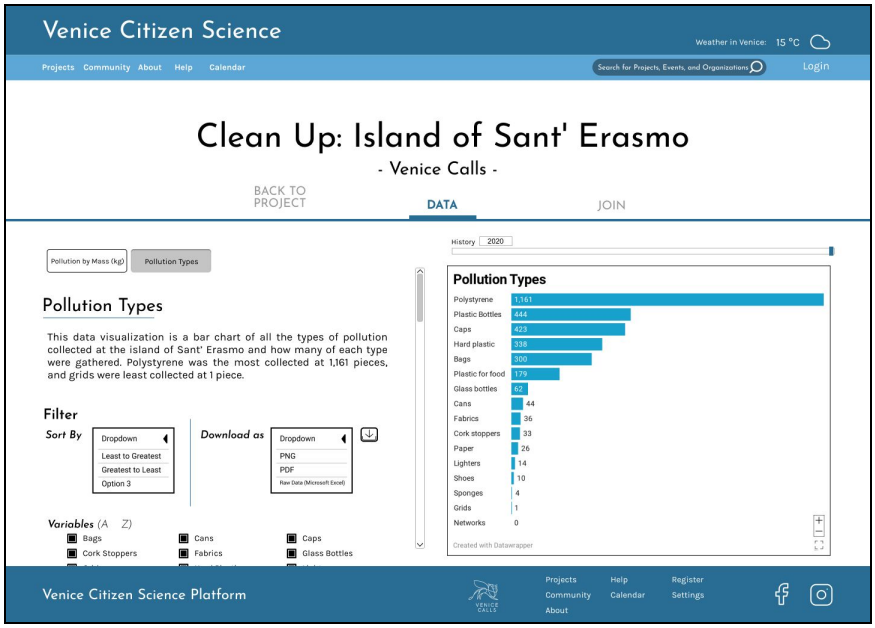
Event “Clean Up: Island of Sant’ Erasmo” Data Page: Pollution by Mass (kg) Database [top]



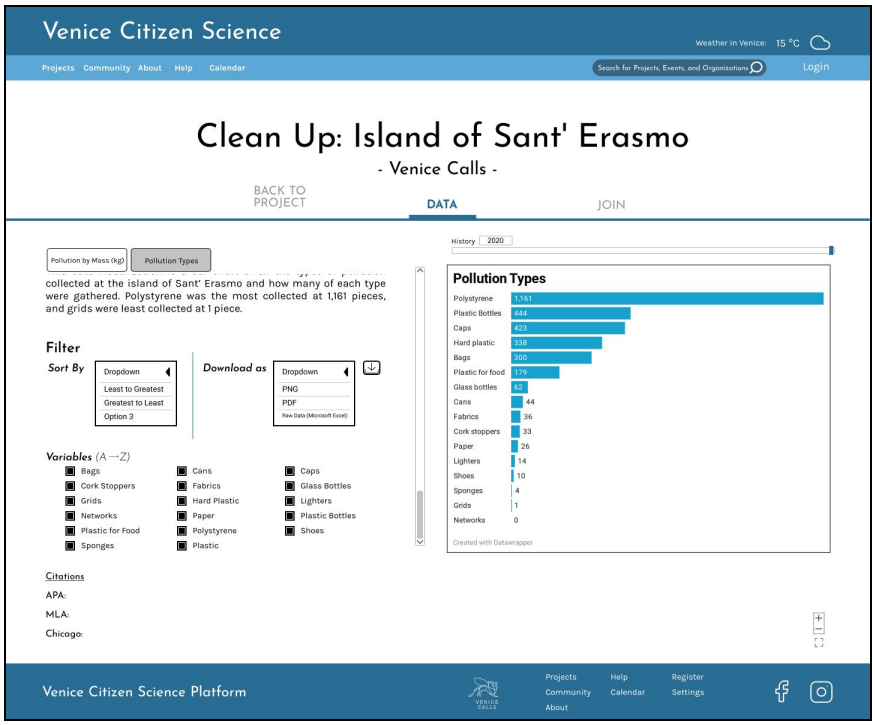
Event “Clean Up: Island of Sant’ Erasmo” Data Page: Pollution by Mass (kg) Database [bottom]



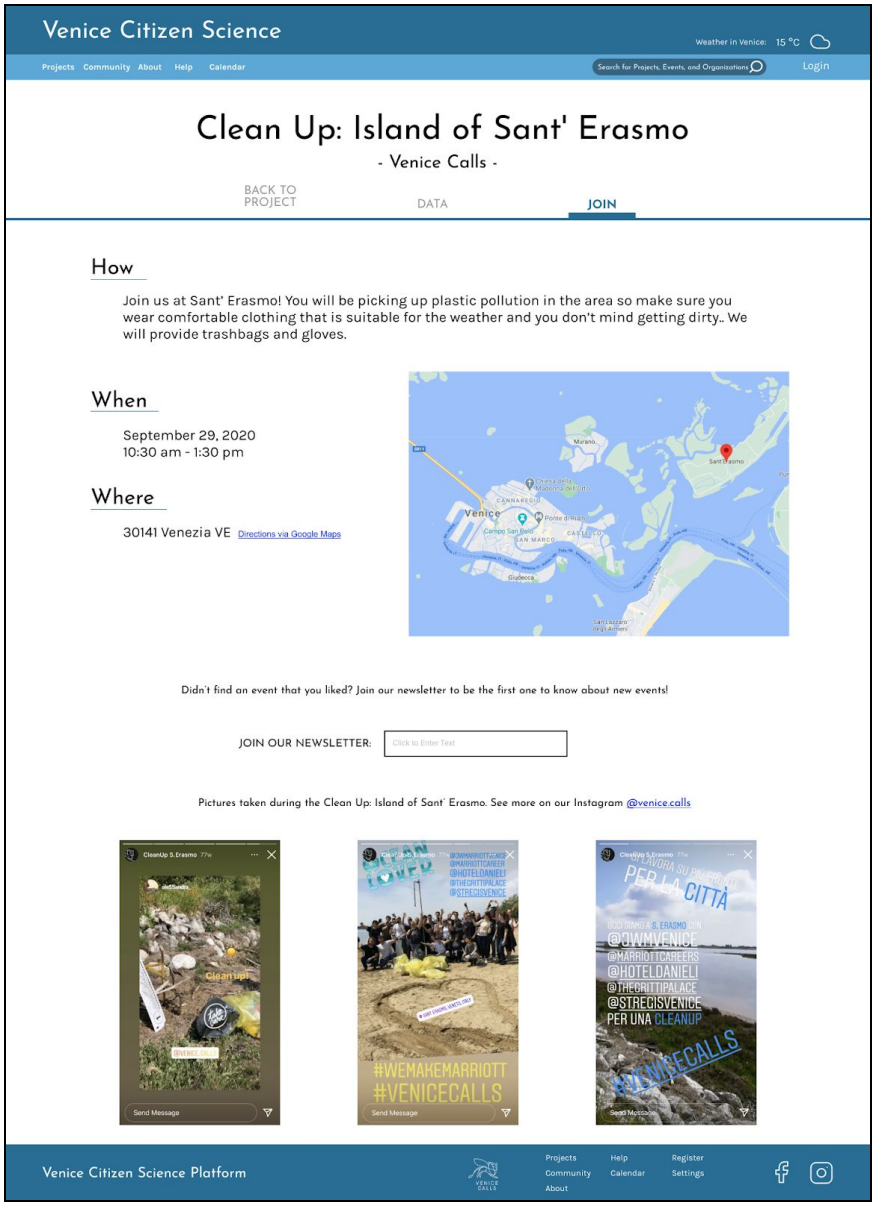
Event “Clean Up: Island of Sant’ Erasmo” Data Page: Pollution Types Database [top]



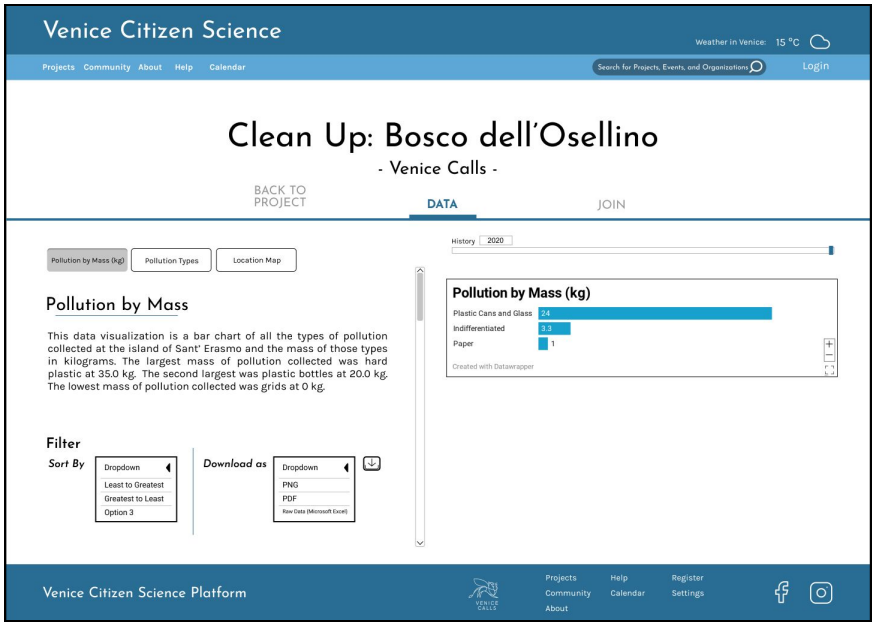
Event “Clean Up: Island of Sant’ Erasmo” Data Page : Pollution Types Database[bottom]



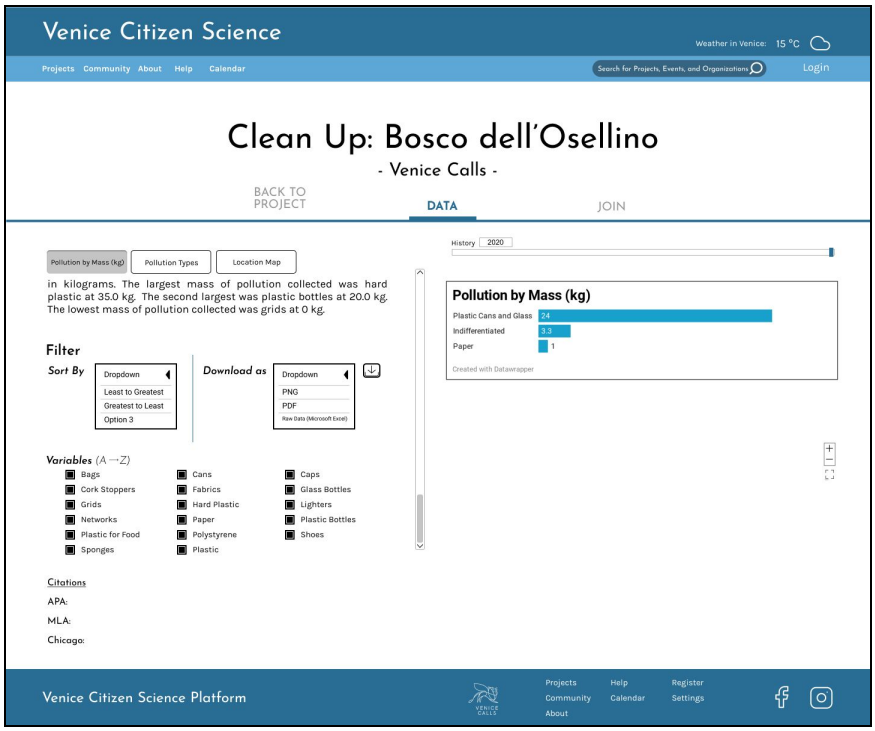
Event “Clean Up: Island of Sant’ Erasmo” Join Page



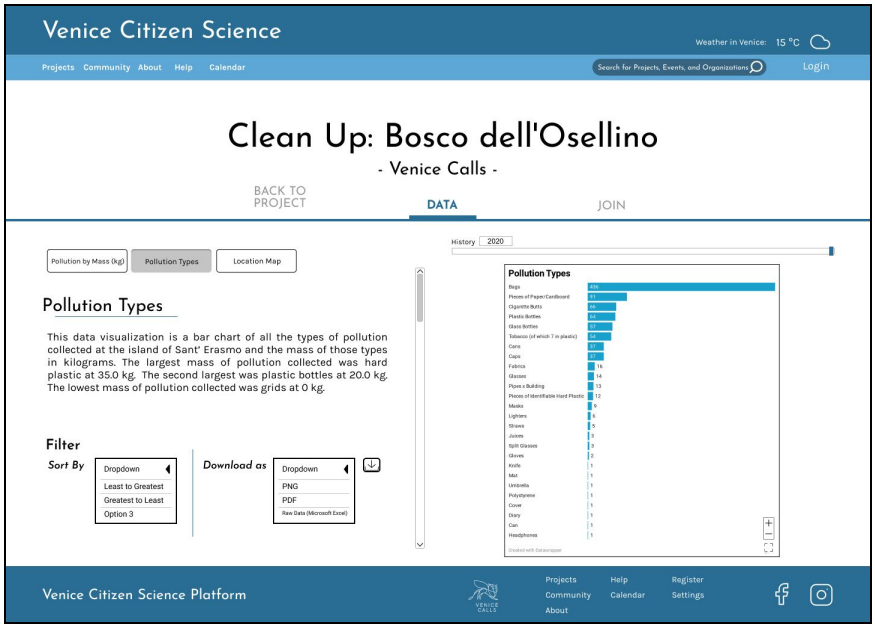
Event “Clean Up: Bosco dell’Osellino” Data Page: Pollution by Mass (kg) Database[top]



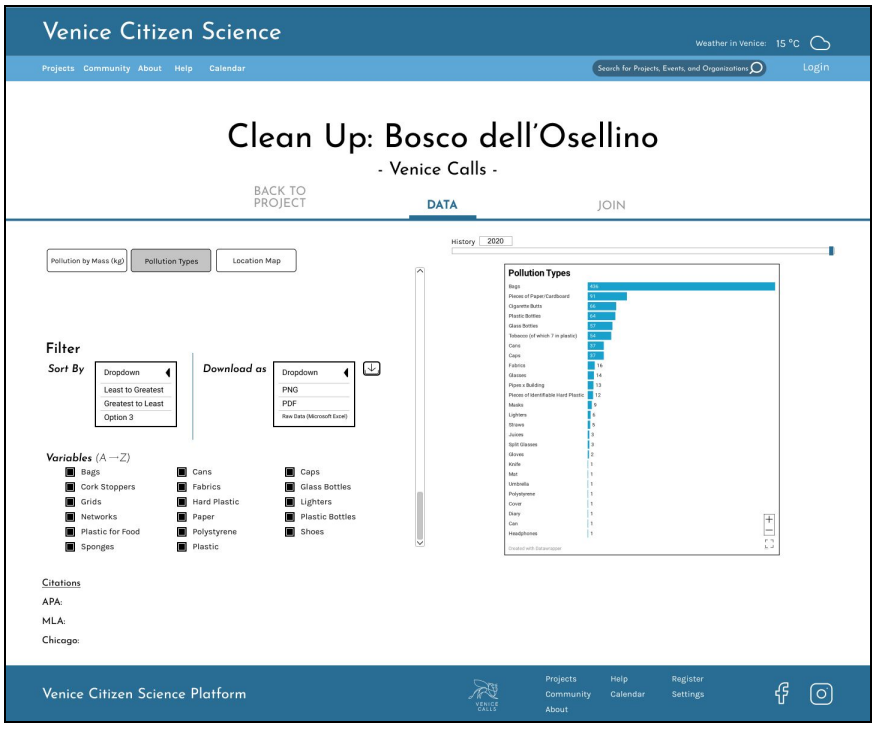
Event “Clean Up: Bosco dell’Osellino” Data Page: Pollution by Mass (kg) Database[bottom]



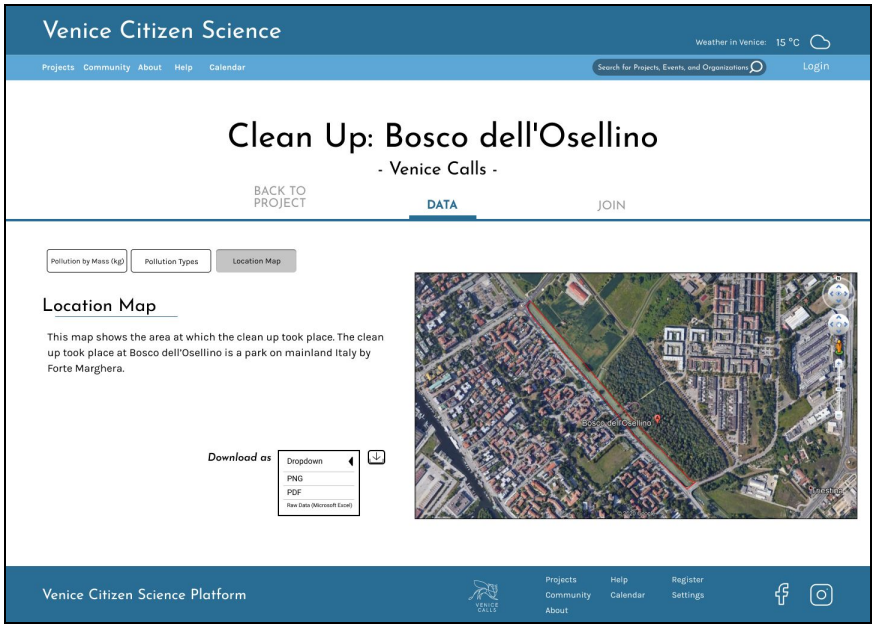
Event “Clean Up: Bosco dell’Osellino” Data Page: Pollution Types Database [top]



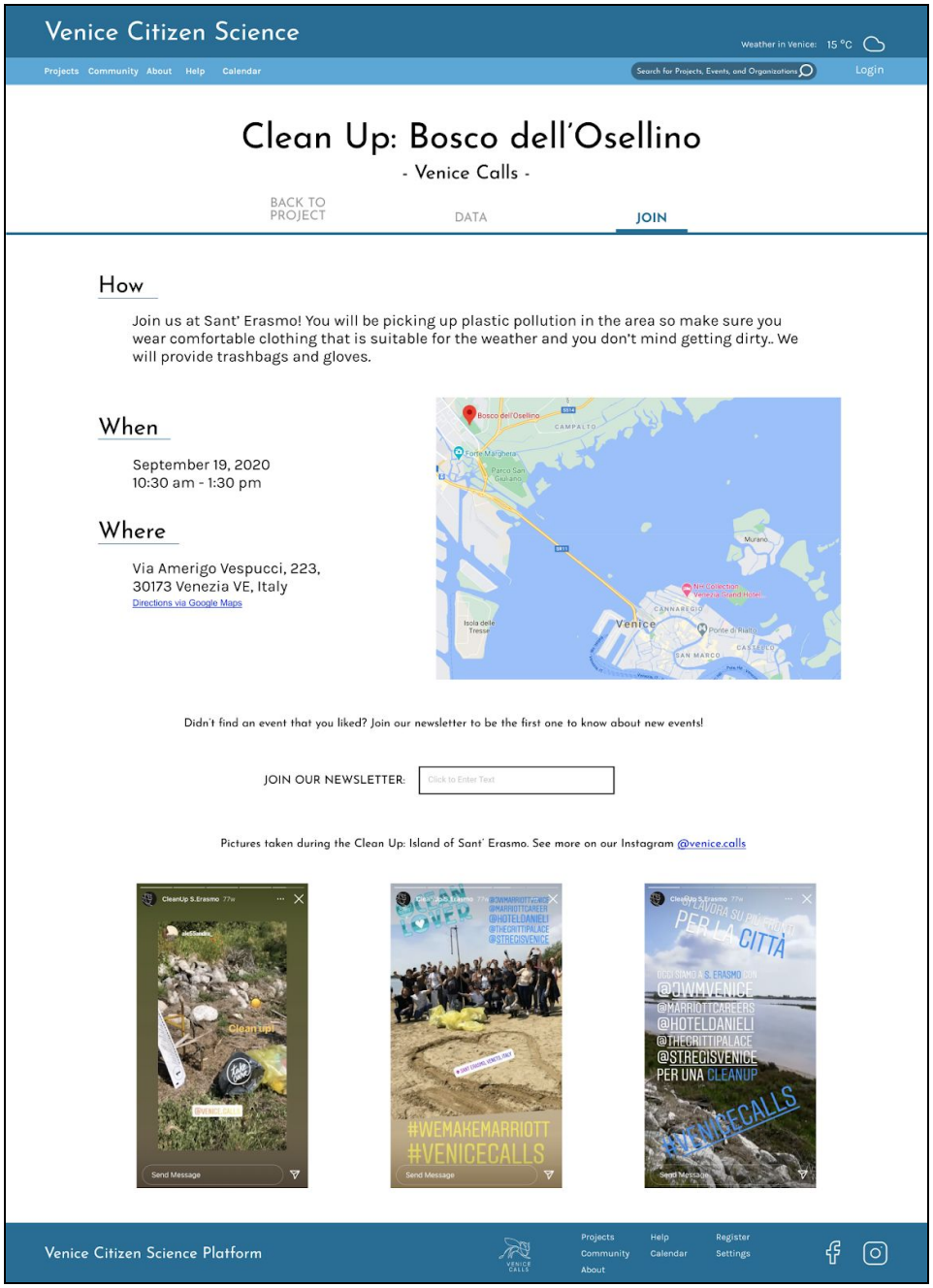
Event “Clean Up: Bosco dell’Osellino” Data Page: Pollution Types Database [bottom]



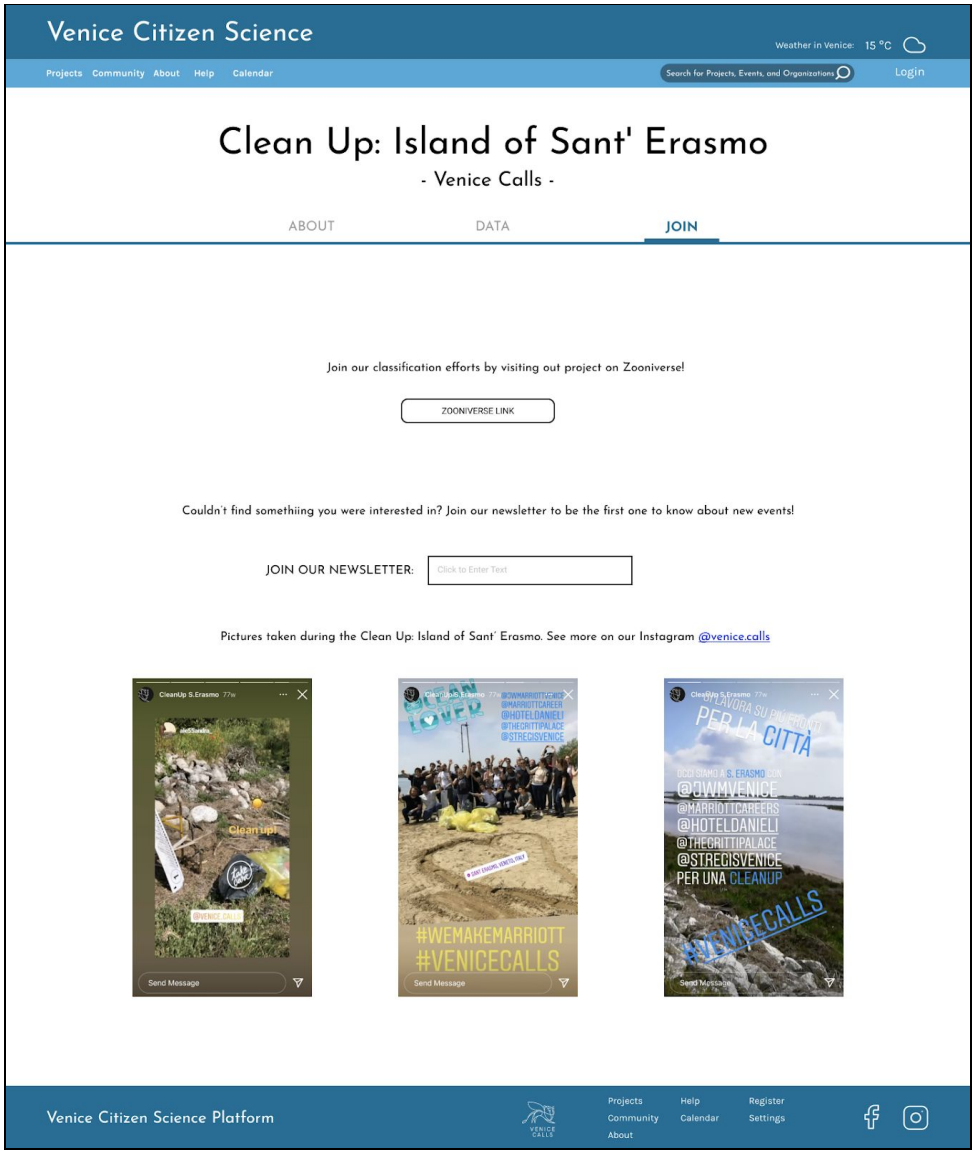
Event “Clean Up: Bosco dell’Osellino” Data Page: Location Database



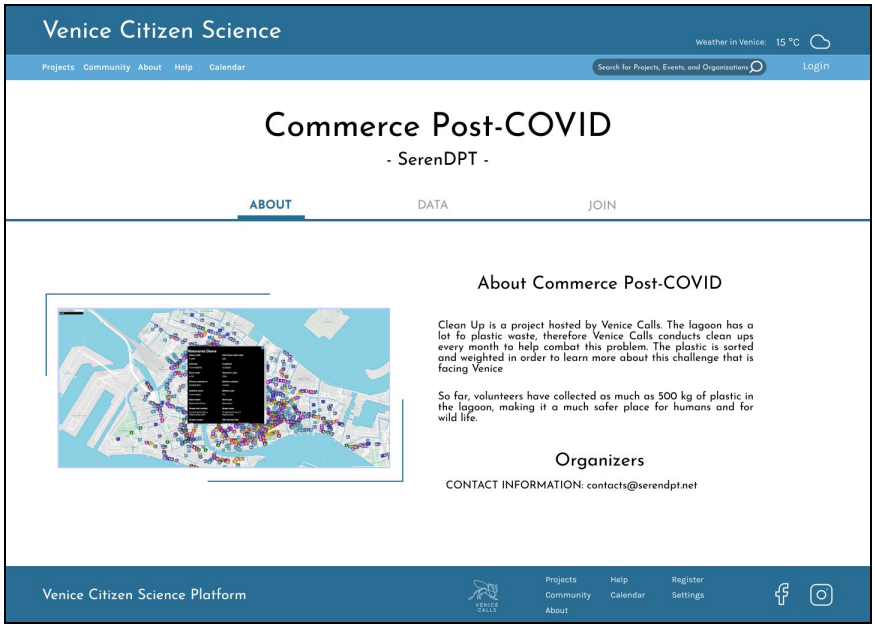
Event “Clean Up: Bosco dell’Osellino” Join Page



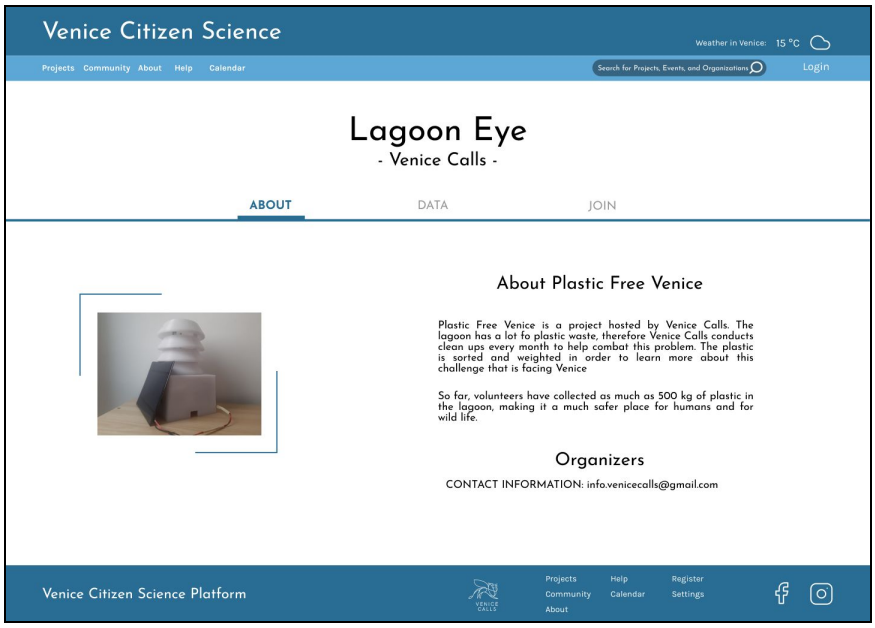
Event “Clean Up: Island of Sant’Erasmo” Join Page - Classification



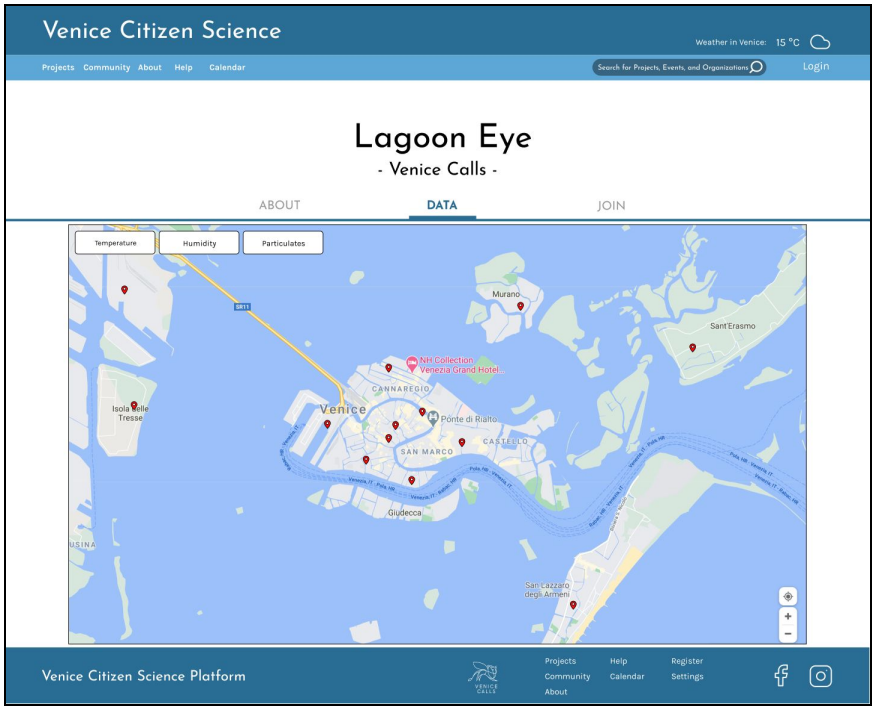
Project “Commerce Post-COVID” About Page



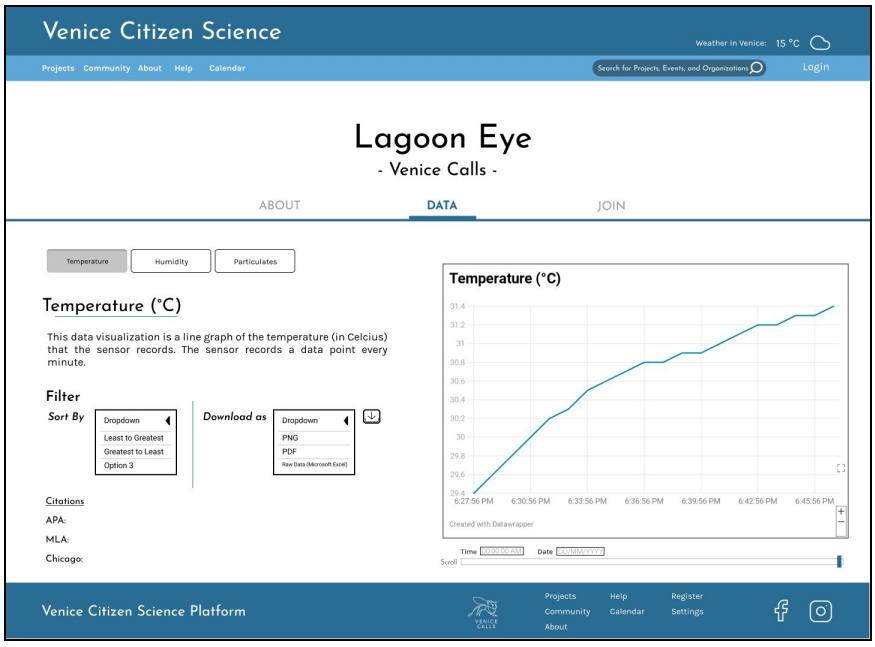
Project “Lagoon Eye” About Page



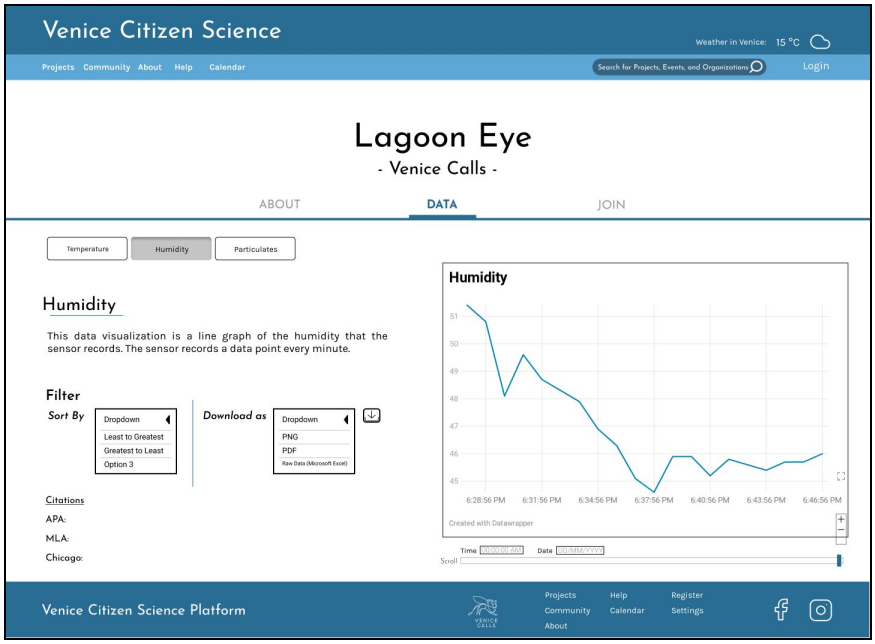
Project “Lagoon Eye” Data Page: Location of Sensors Database



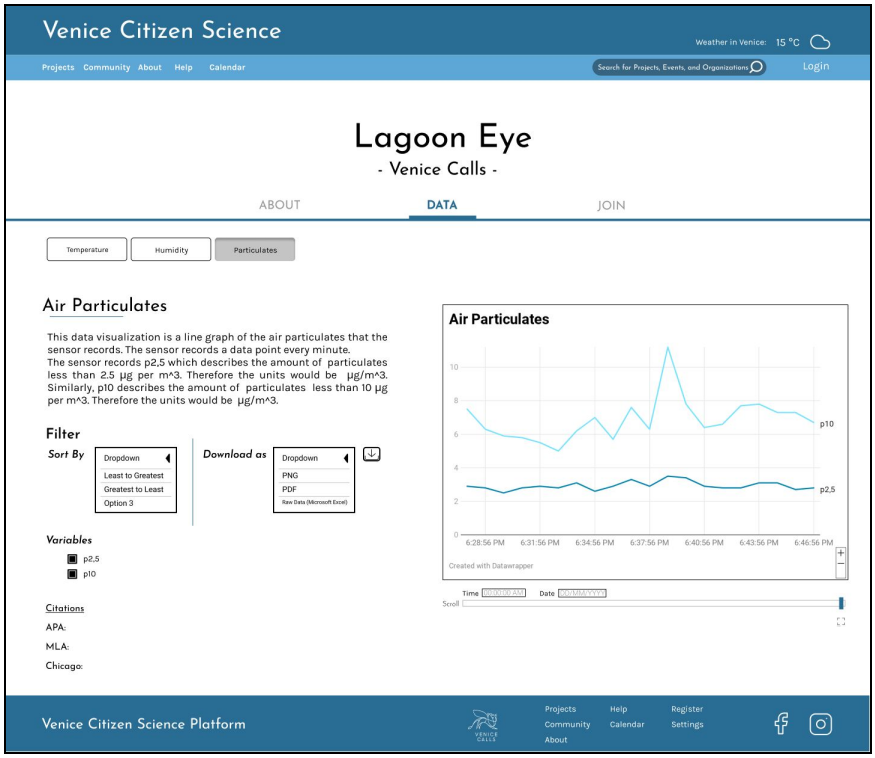
Project “Lagoon Eye” Data Page: Temperature Database



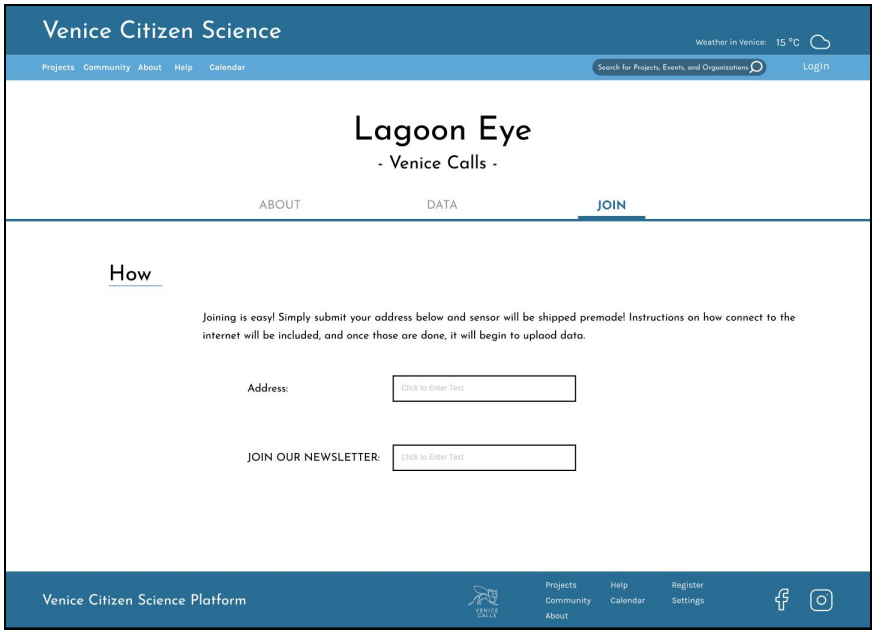
Project “Lagoon Eye” Data Page: Humidity Database



Project “Lagoon Eye” Data Page: Particulates Database

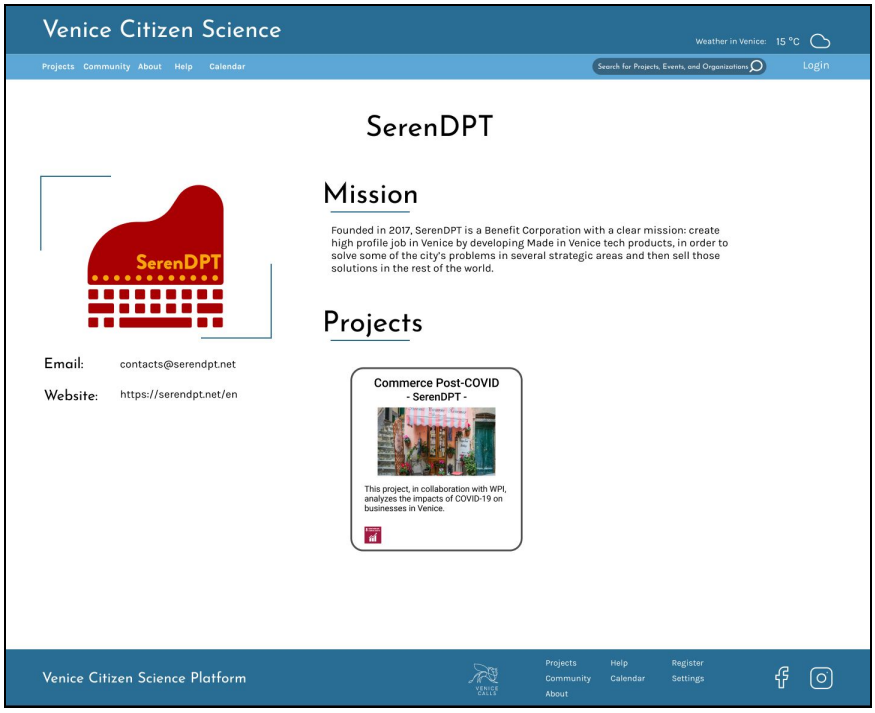


Project “Lagoon Eye” Join Page



Organization “Venice Calls” Page

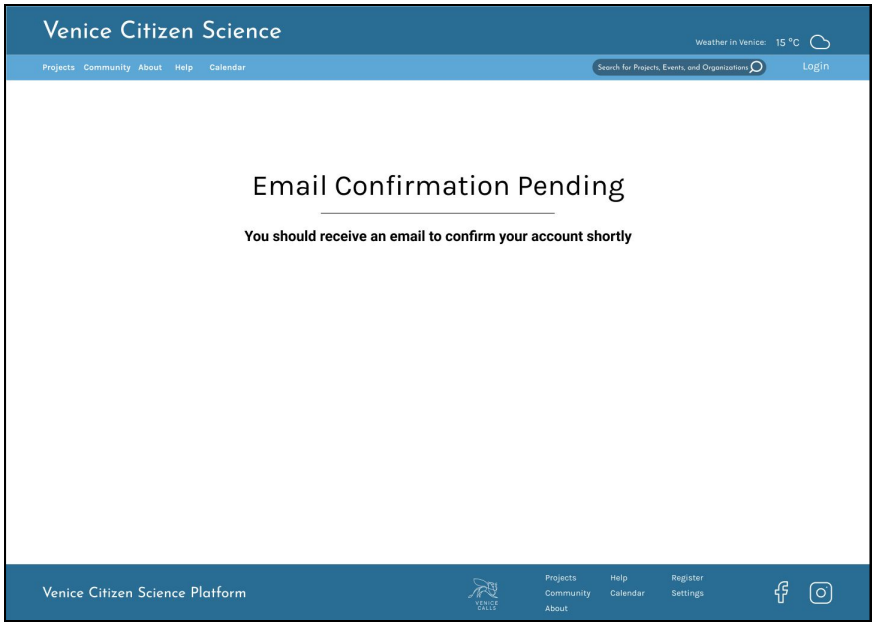
Organization “SerenDPT” Page



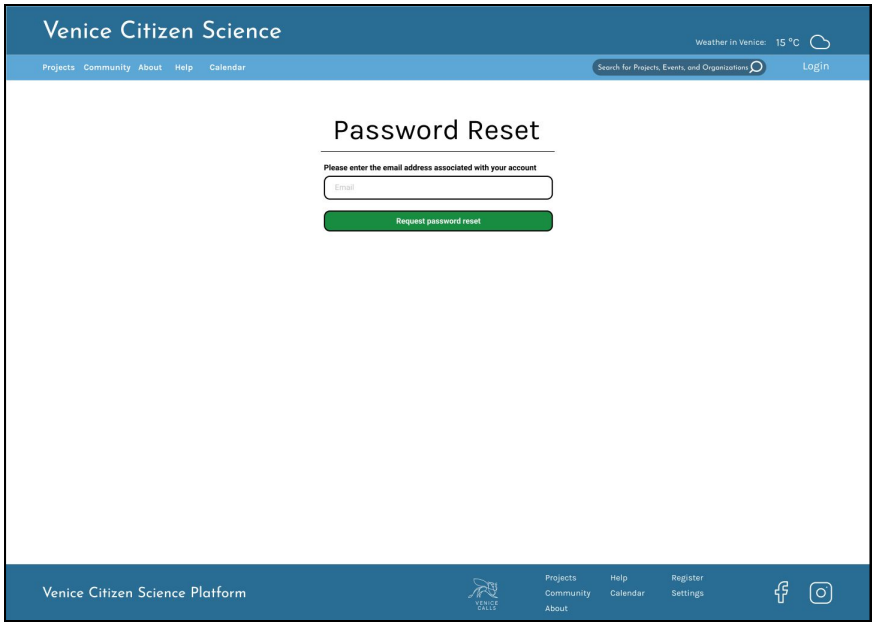
Log In Page

Register A New User Page

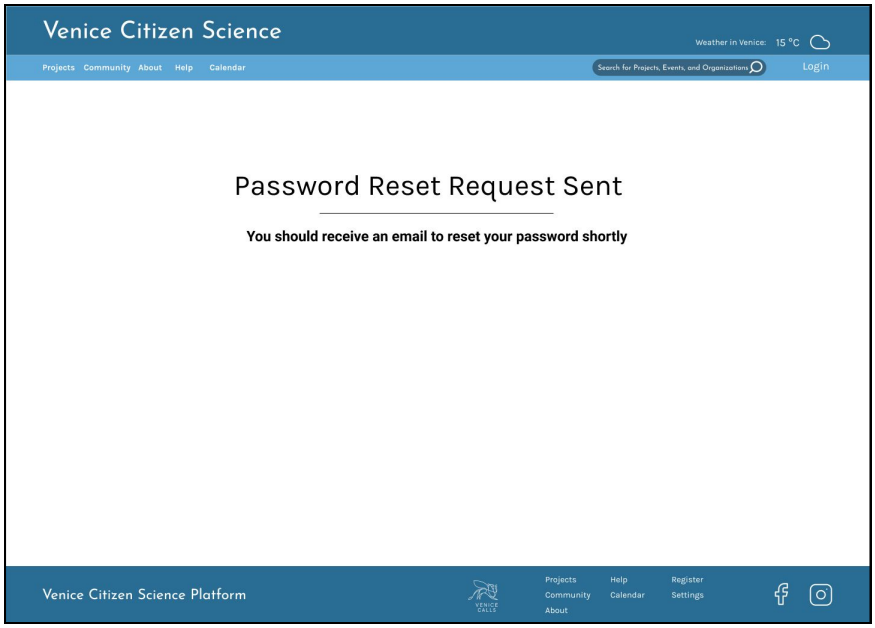
Account Confirmation Sent Page



Password Reset Page



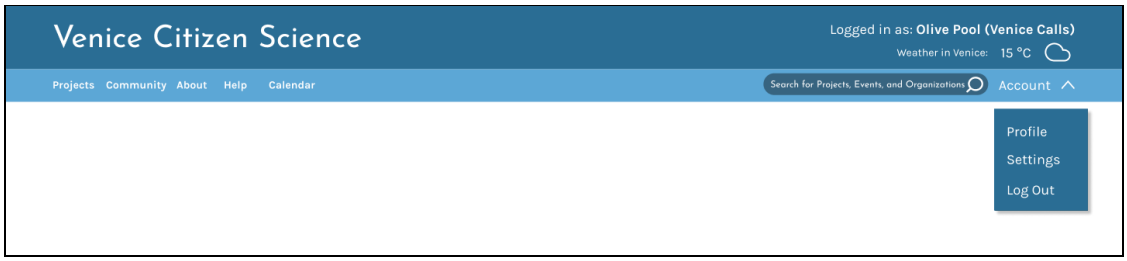
Password Reset Request Sent Page



Appendix G - The Application: Logged In View

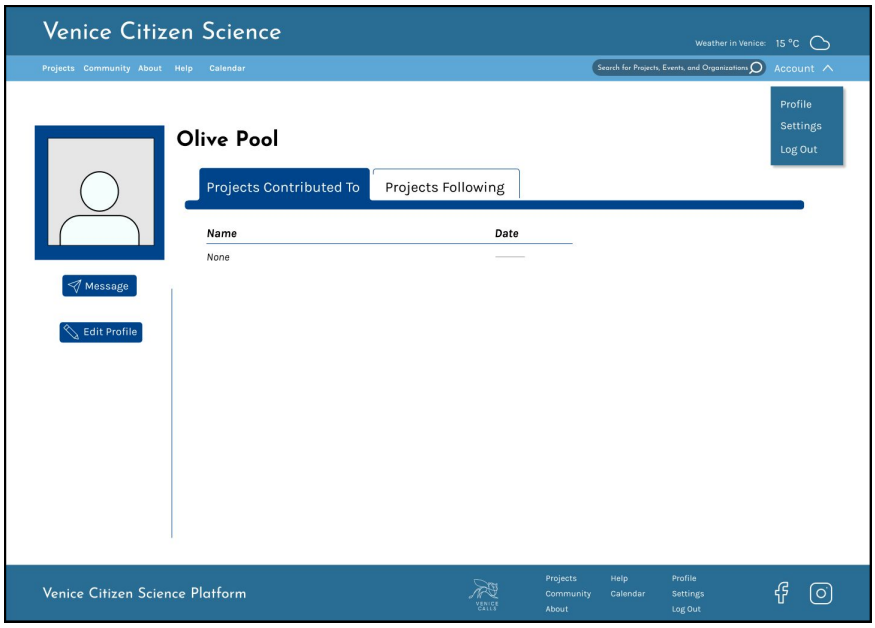
All the frames in Appendix E also exist in this appendix. The only difference is the header and footer, seen below. Only frames not related to the Visitor View will be featured in Appendix F.

Header For Logged In

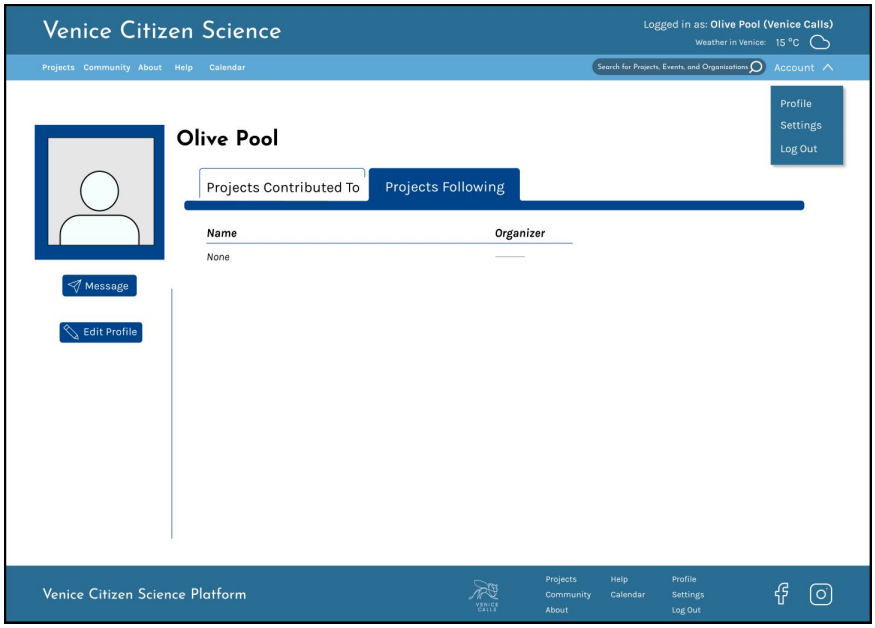


Footer For Logged In

Default User Profile Page 1



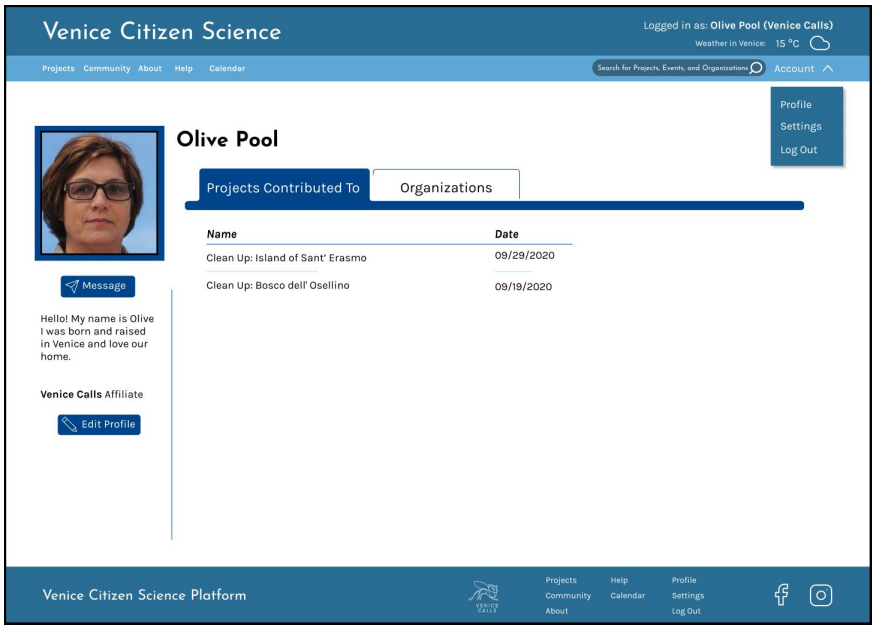
Default User Profile Page 2



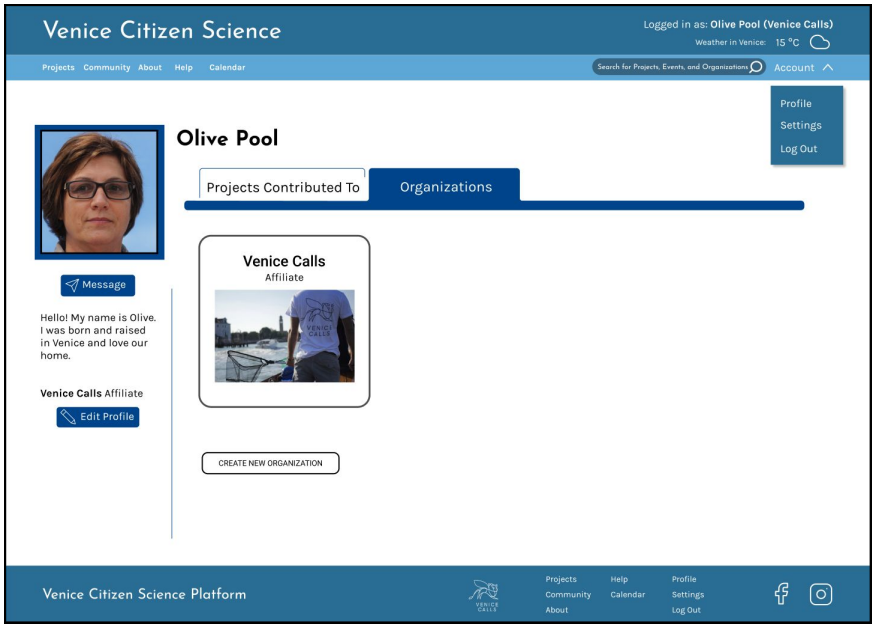
Default Edit User Profile Page

Filled In Edit User Profile Page

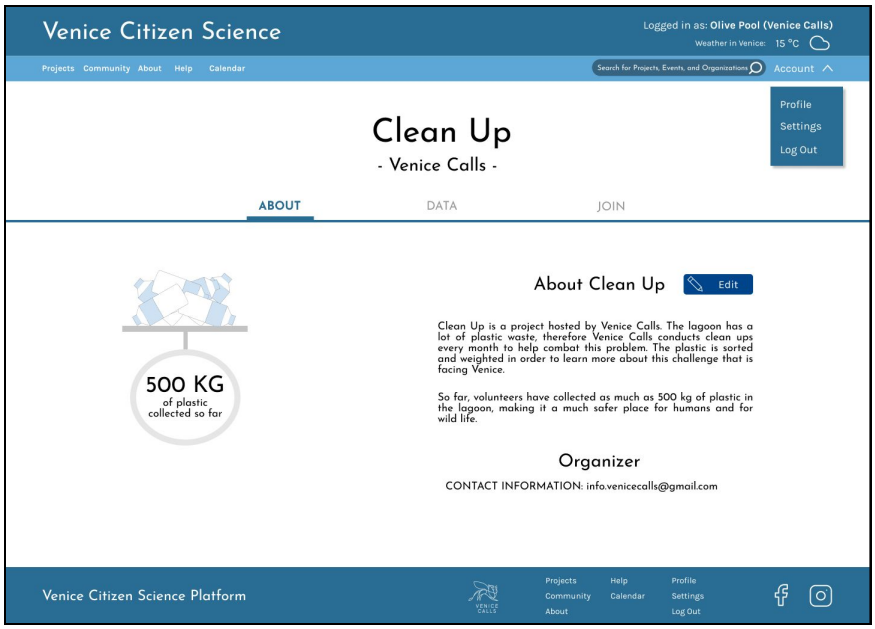
Edited User Profile Page 1



Edited User Profile Page 2

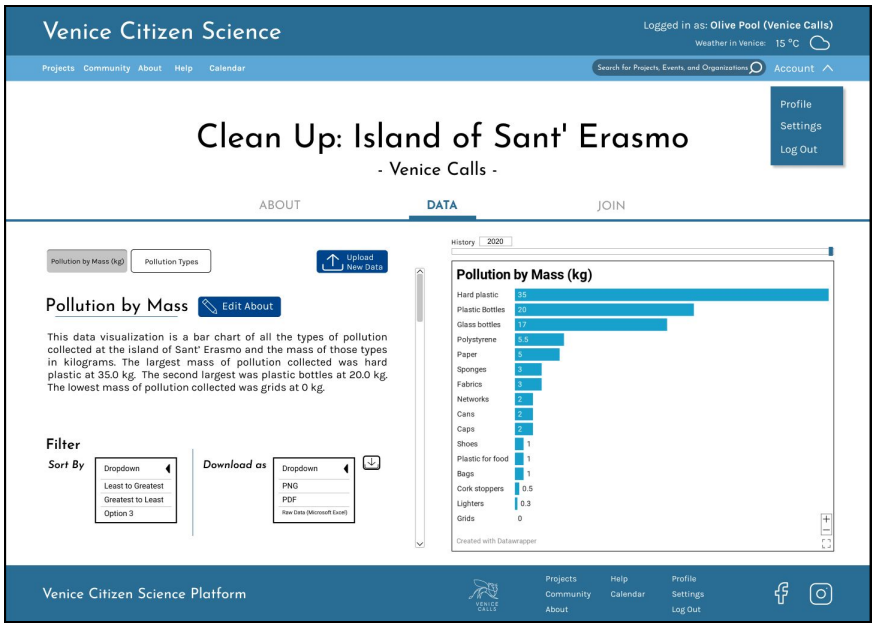


Edit Project About Page



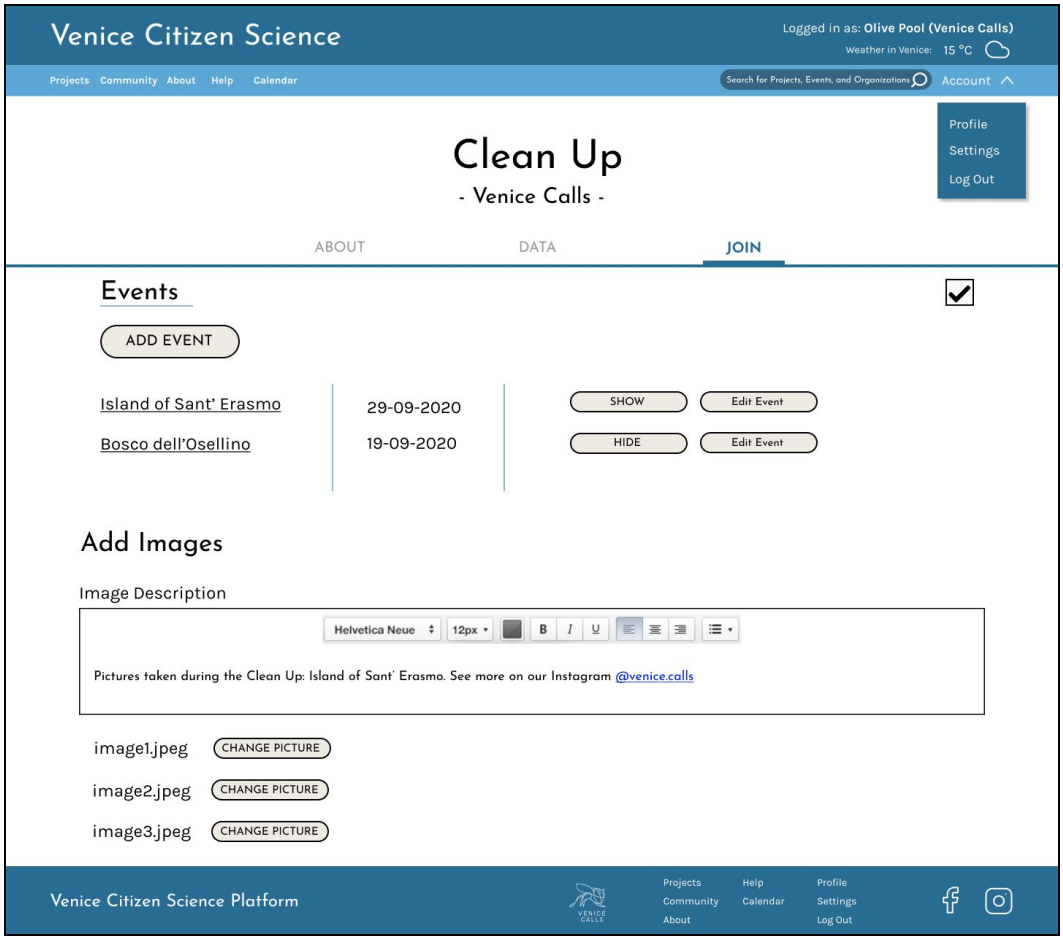
Edit Project About Confirm Page

Edit Project Data Page

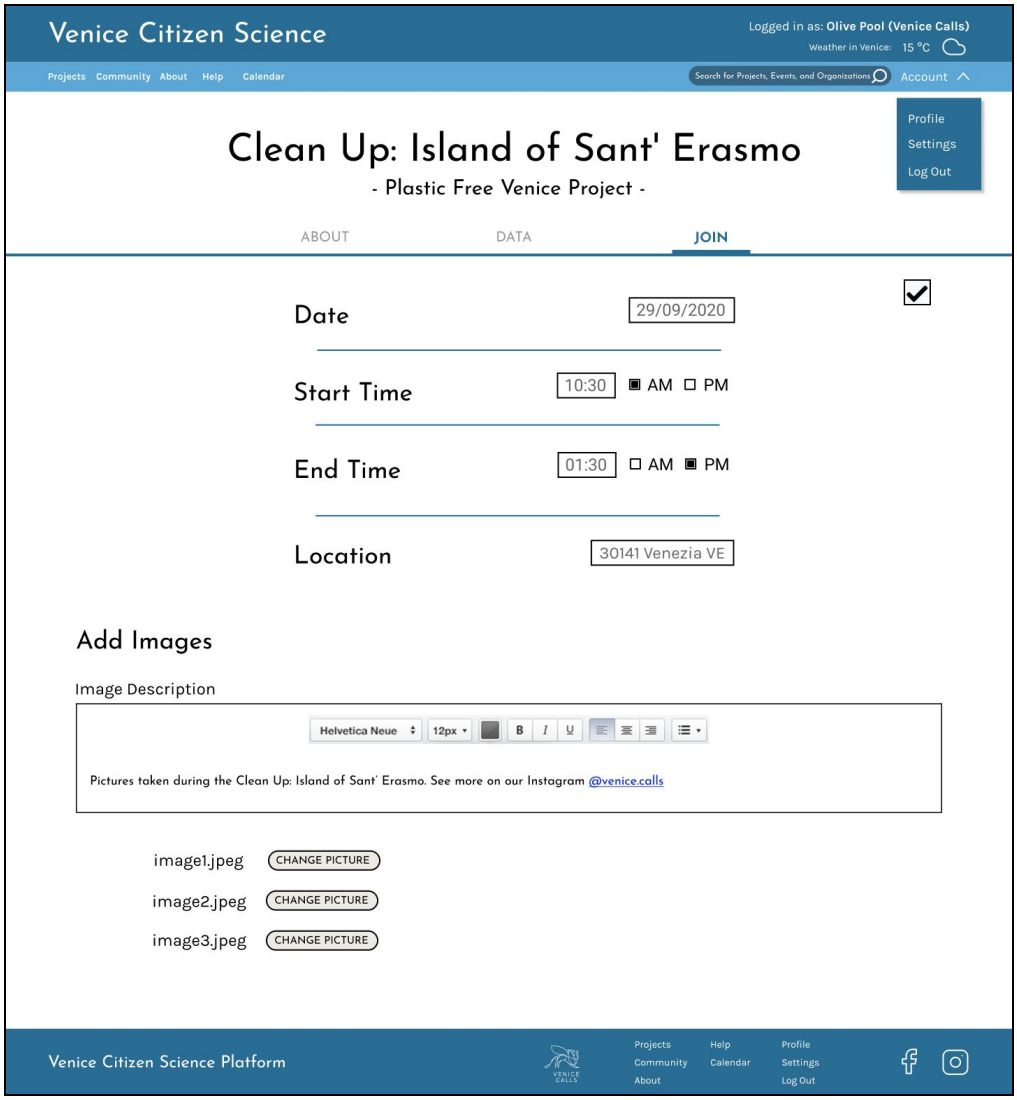


All project data pages will have the same two buttons of “Edit About” and “Upload New Data” and they will be in the same positions regardless of project/data set. The other example project frames will not be included in this appendix.

Edit Project Join Page



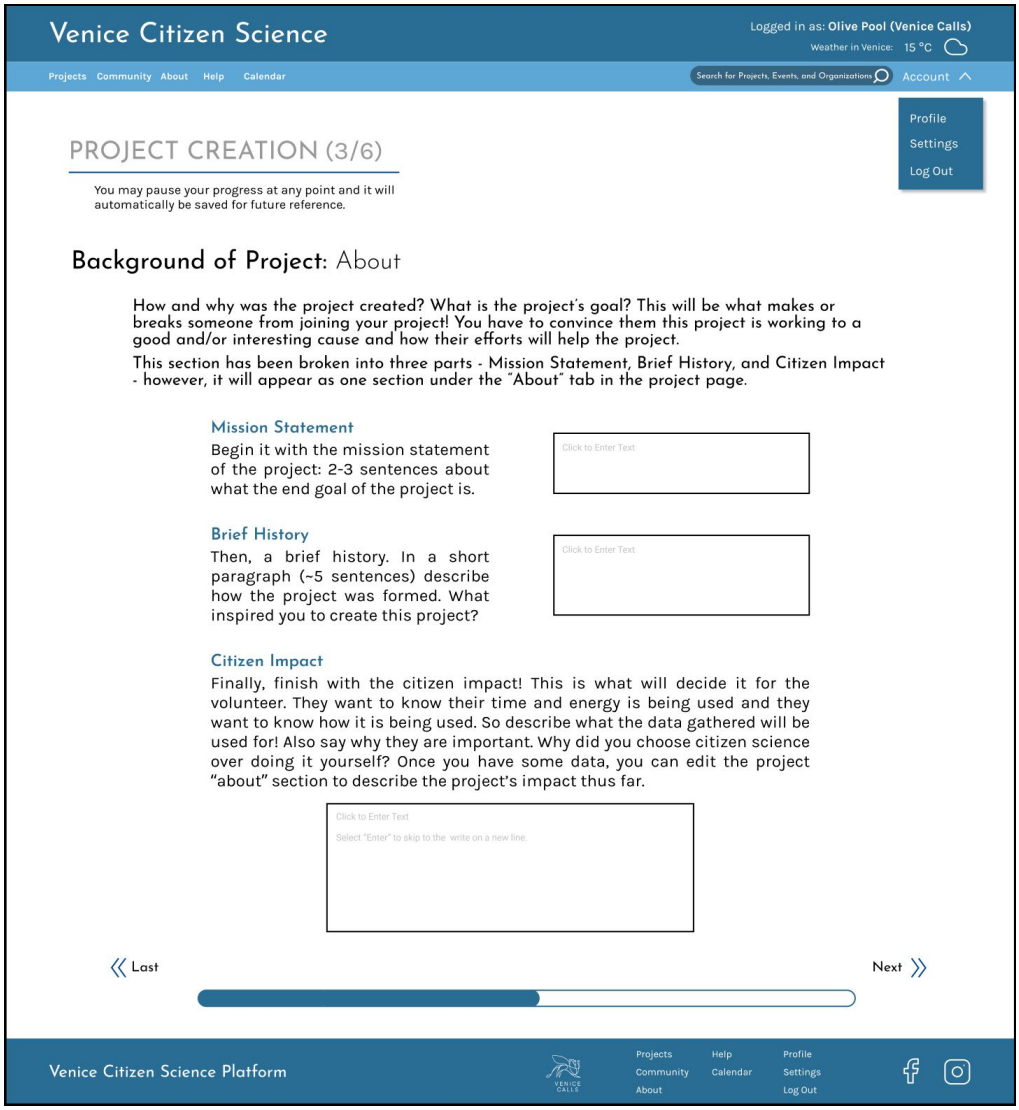
Edit Event Join Page



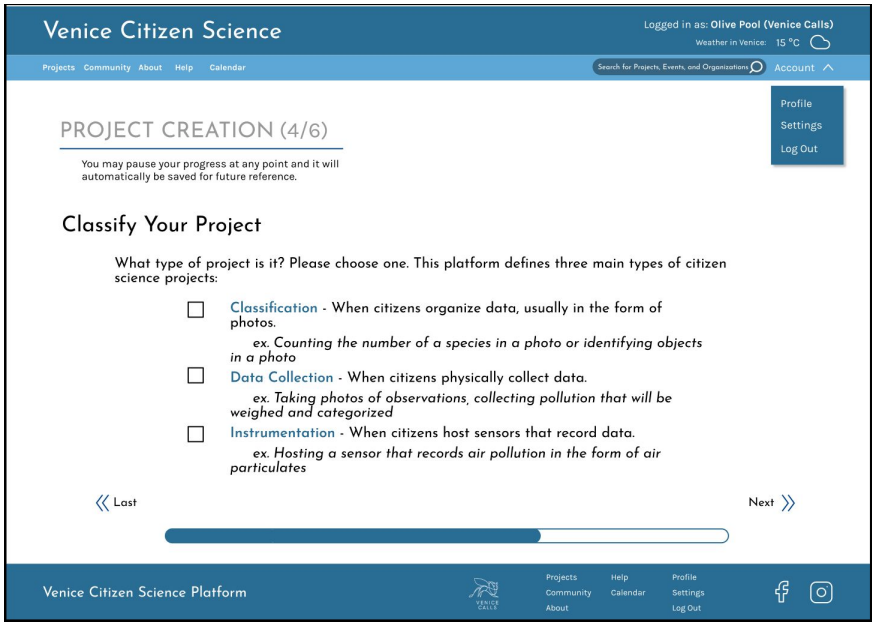
Project Creation Page: Step 1

Project Creation Page: Step 2

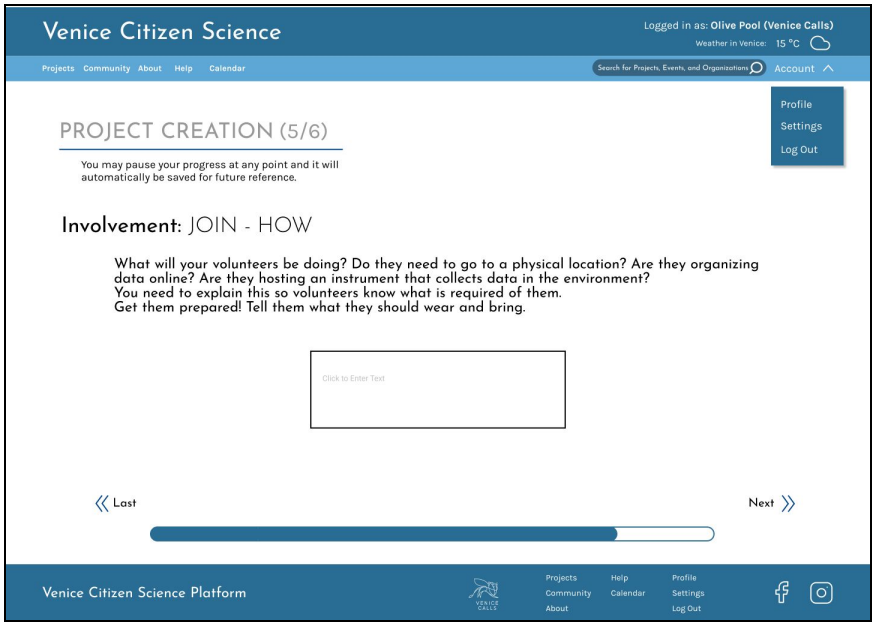
Project Creation Page: Step 3



Project Creation Page: Step 4

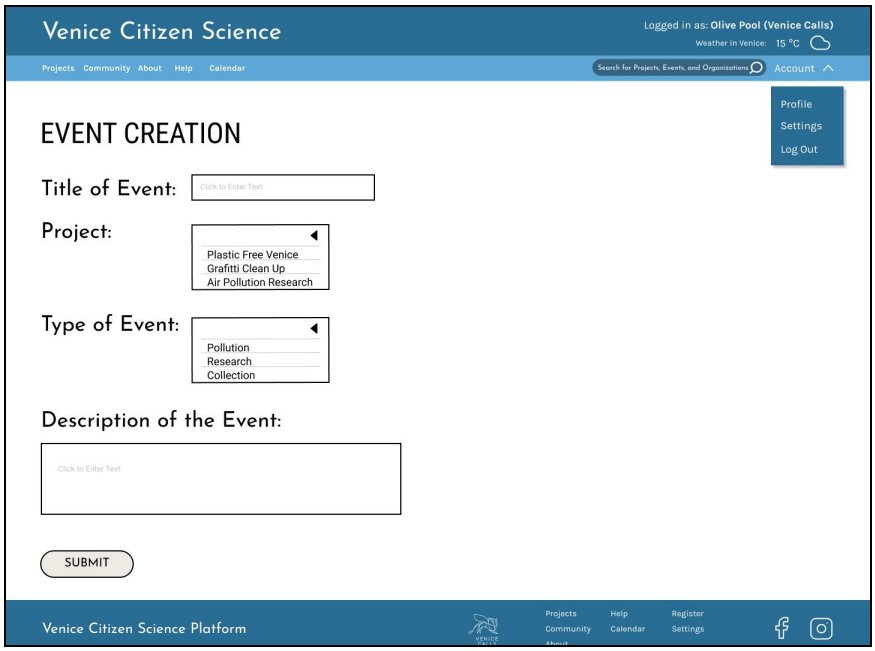


Project Creation Page: Step 5



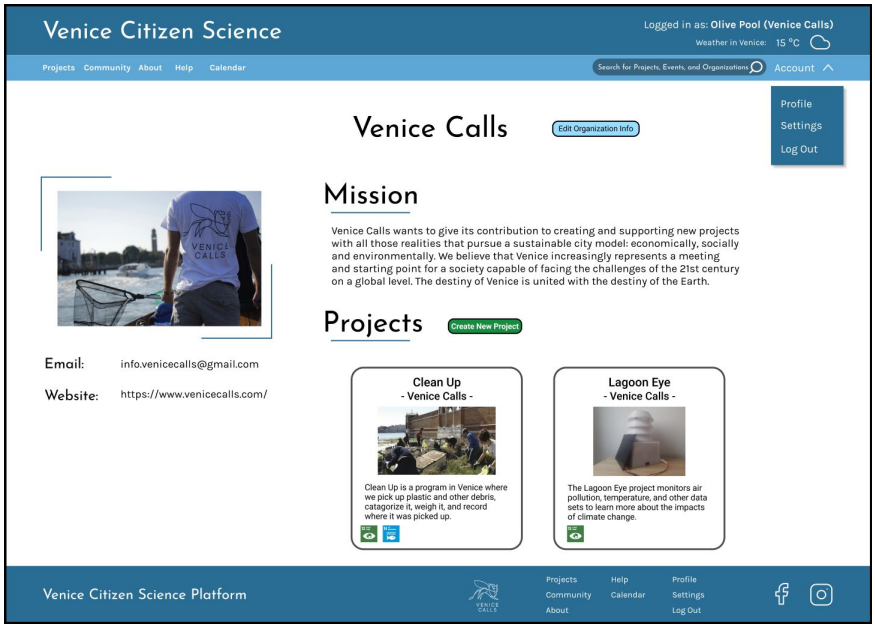
Project Creation Page: Step 6

Event Creation Page



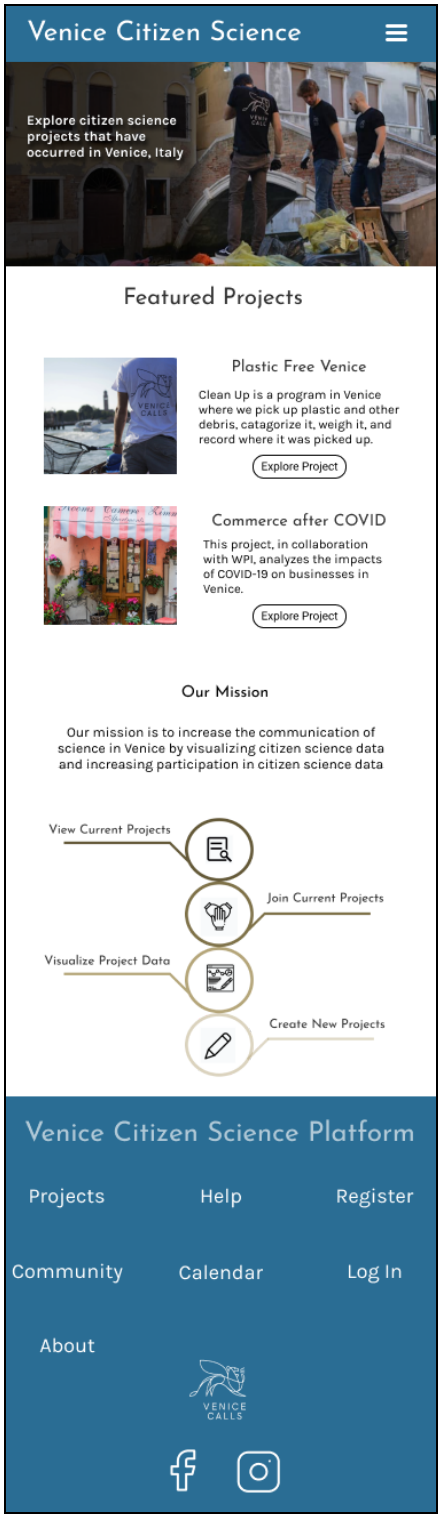
Organization Creation Page

Organization “Venice Calls” Page

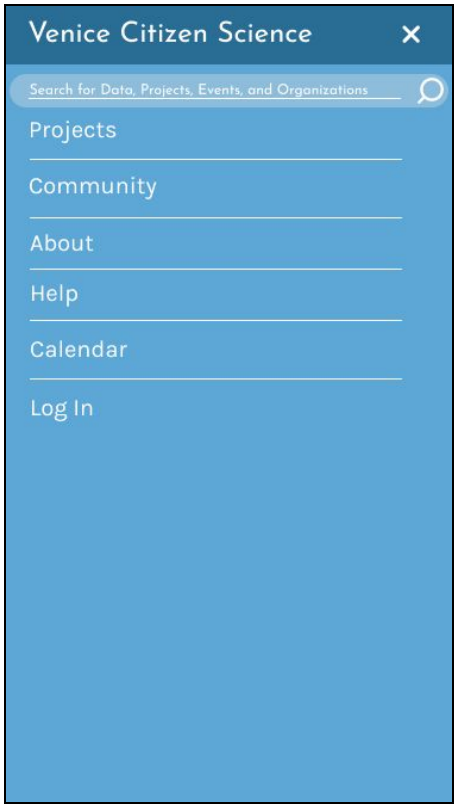


Appendix H - The Application: Mobile View

The Home Page

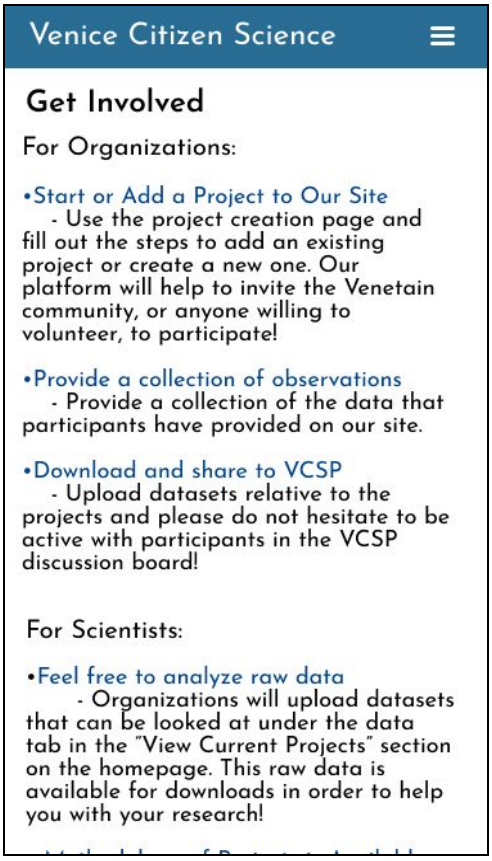


Navigation Bar

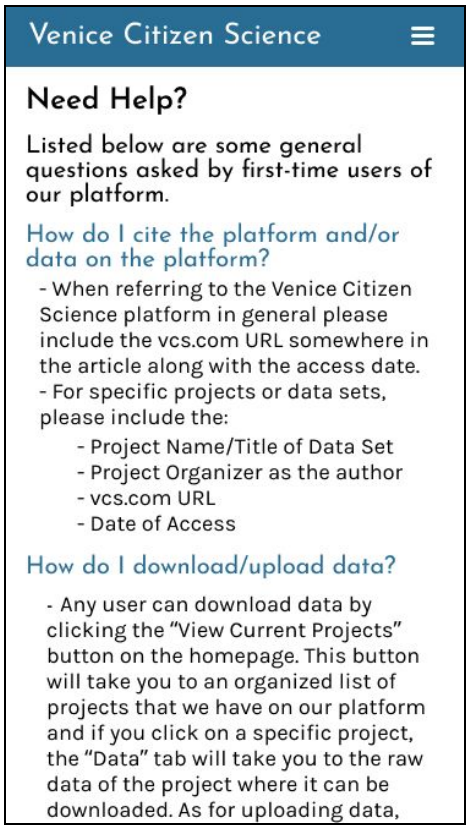


The About Page

Get Involved Page

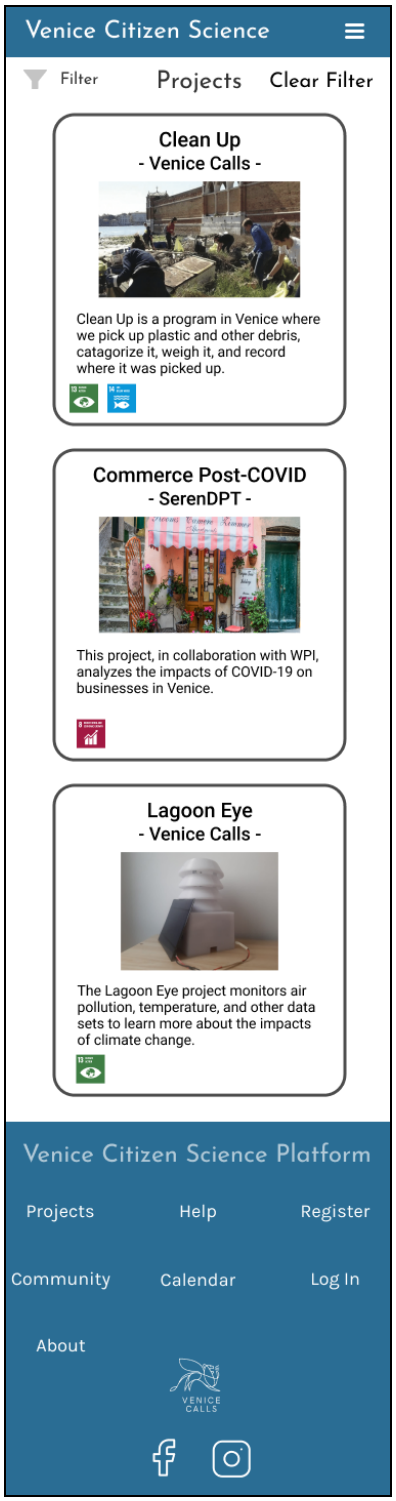


The Help Page



Project Filter Options

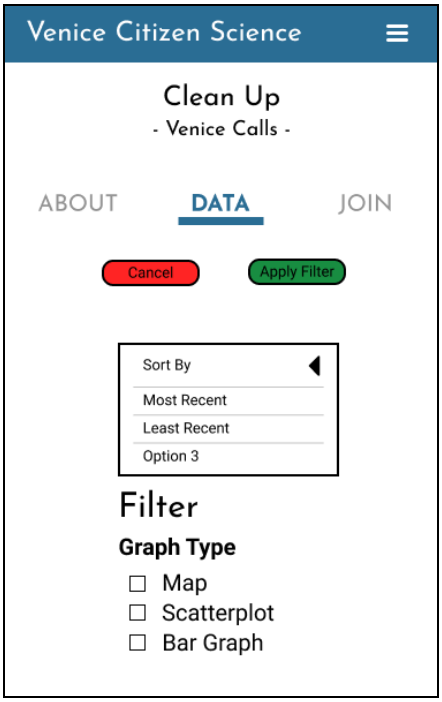
The Project Discovery Page



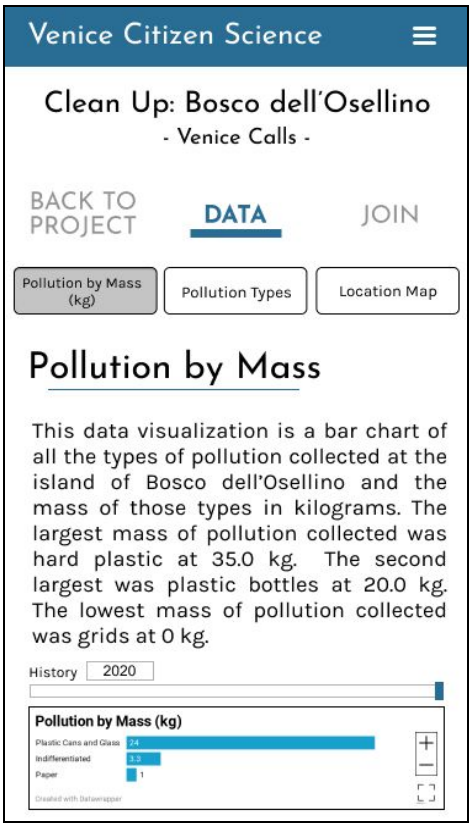
Project“Clean Up” About Page

Project“Clean Up” Data Discovery Page

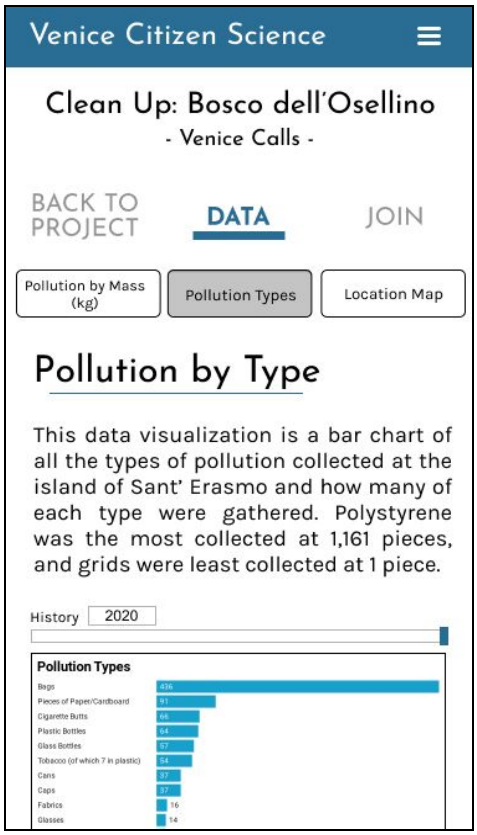
Project “Clean Up” Data Filter Options



Event “Bosco” Pollution Mass Page

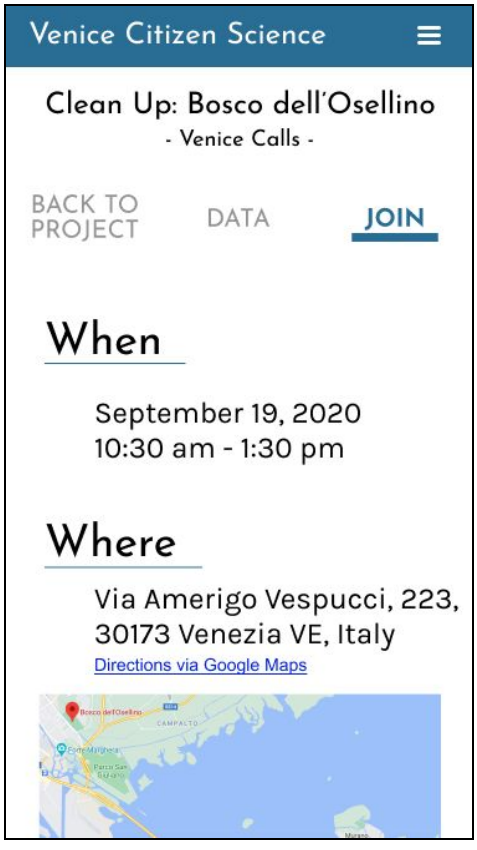


Event “Bosco” Pollution Type Page

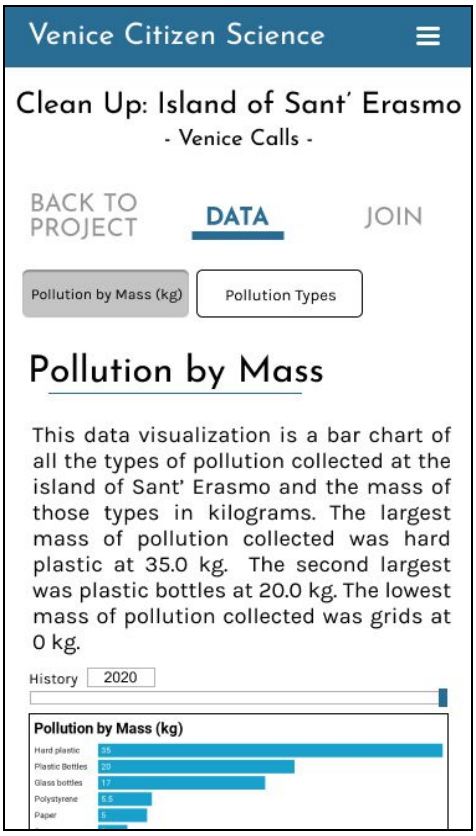


Event “Bosco” Location Map

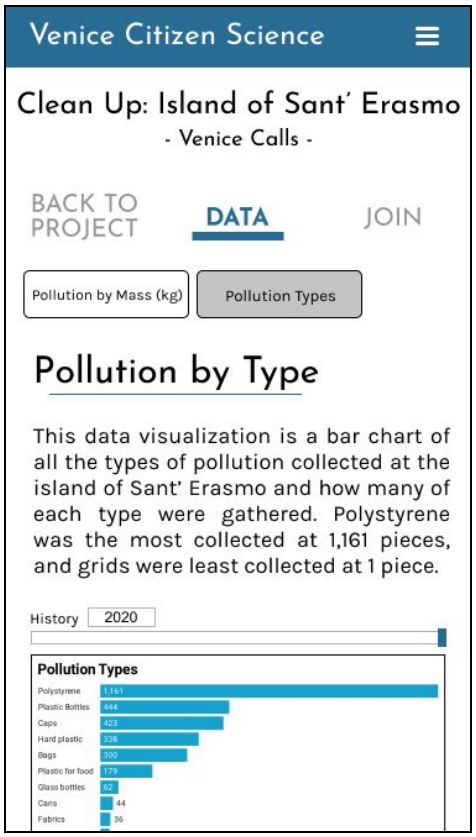
Event “Bosco” Join Page



Event “Sant’ Erasmo” Pollution Mass

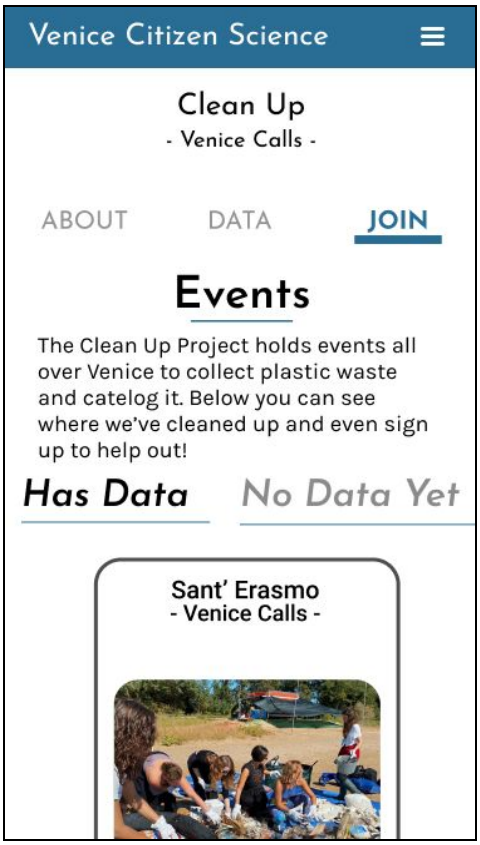


Event “Sant’ Erasmo” Pollution Types

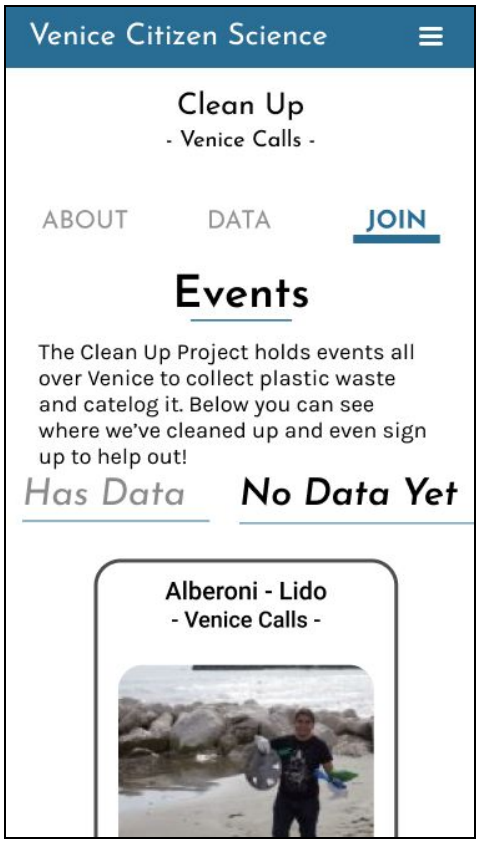


Event “Sant’ Erasmo” Join Page

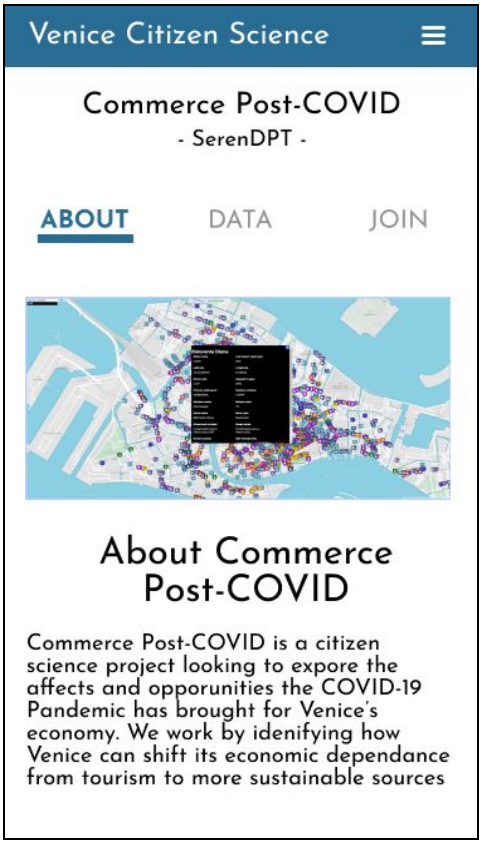
Event “Clean Up” Join Events Page



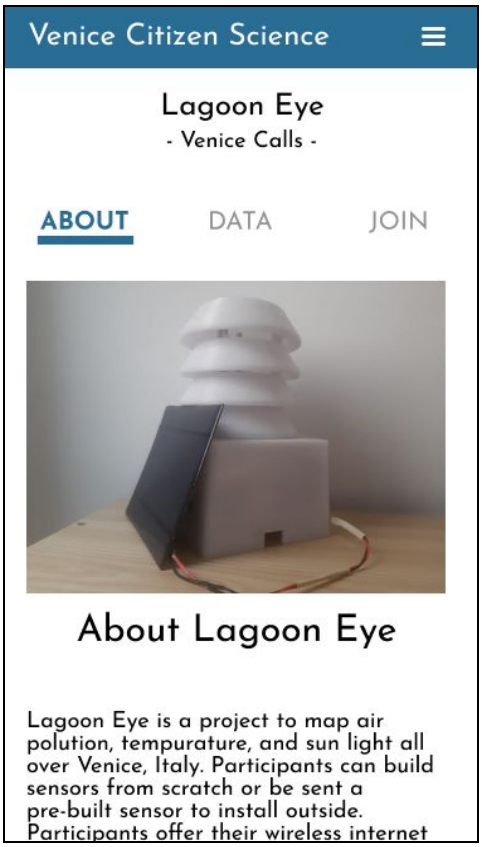
Event “Clean Up” Join Events Page



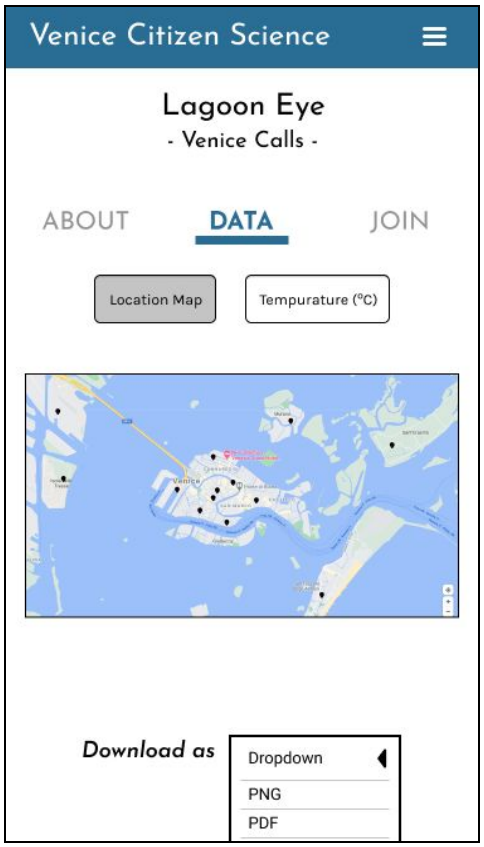
Project “Commerce” About Page



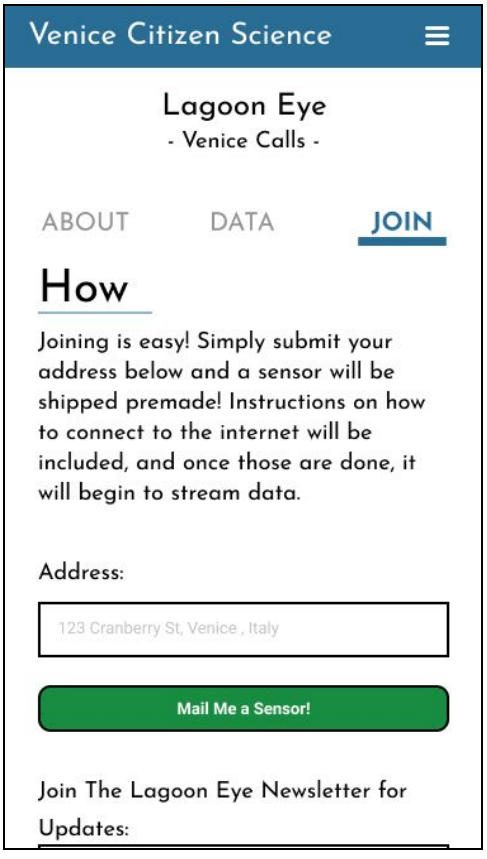
Project “Lagoon Eye” About Page



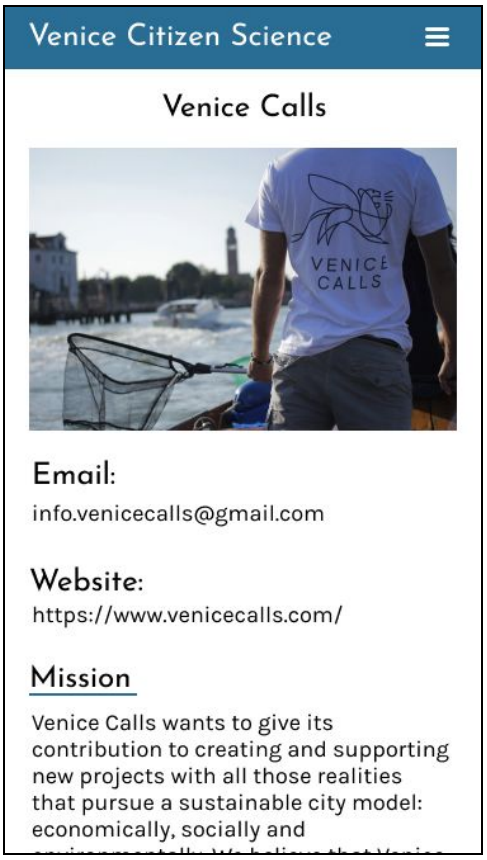
Project “Lagoon Eye” Data Page



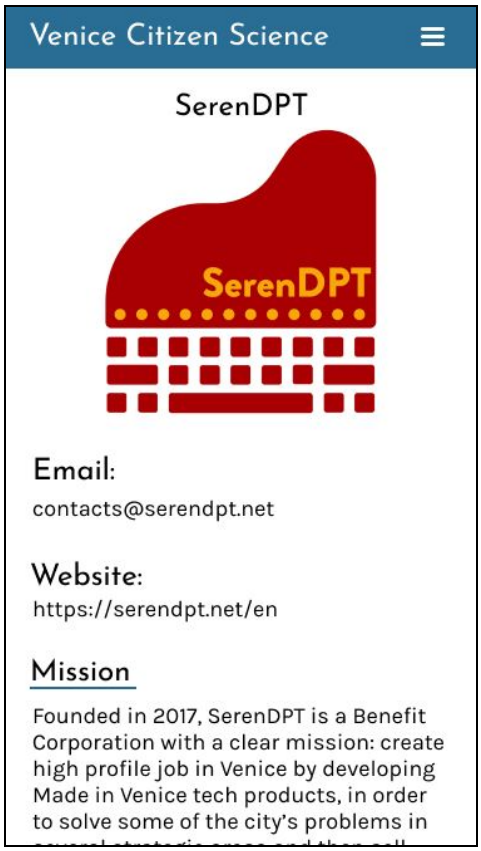
Project “Lagoon Eye” Join Page



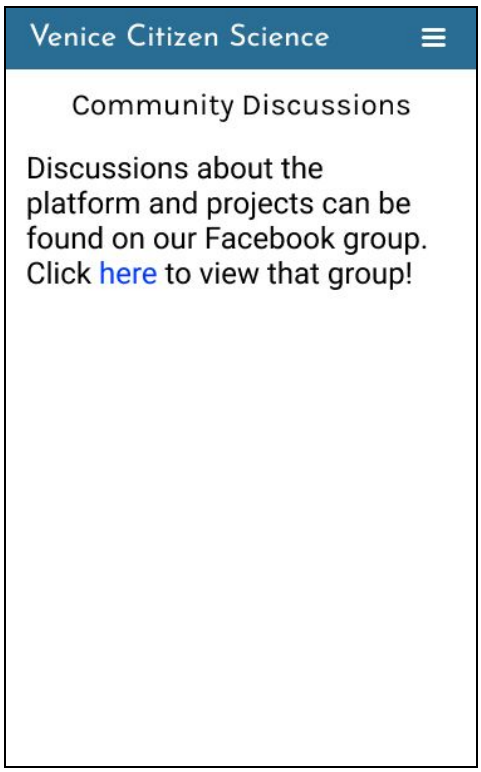
Project “Venice Call” Organizer Page



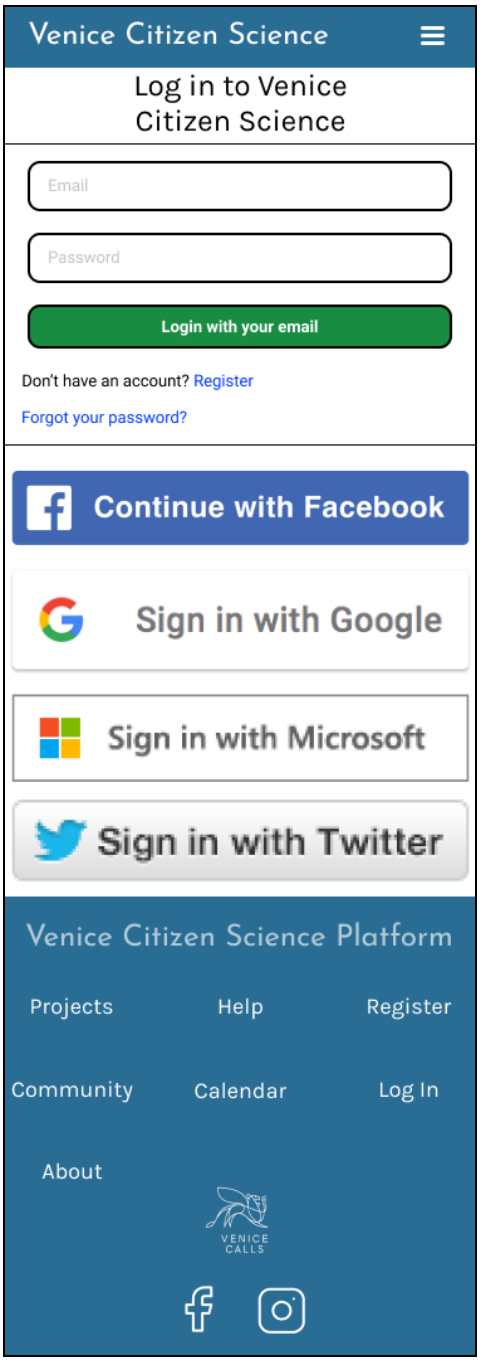
Project “SerenDPT” Organizer Page



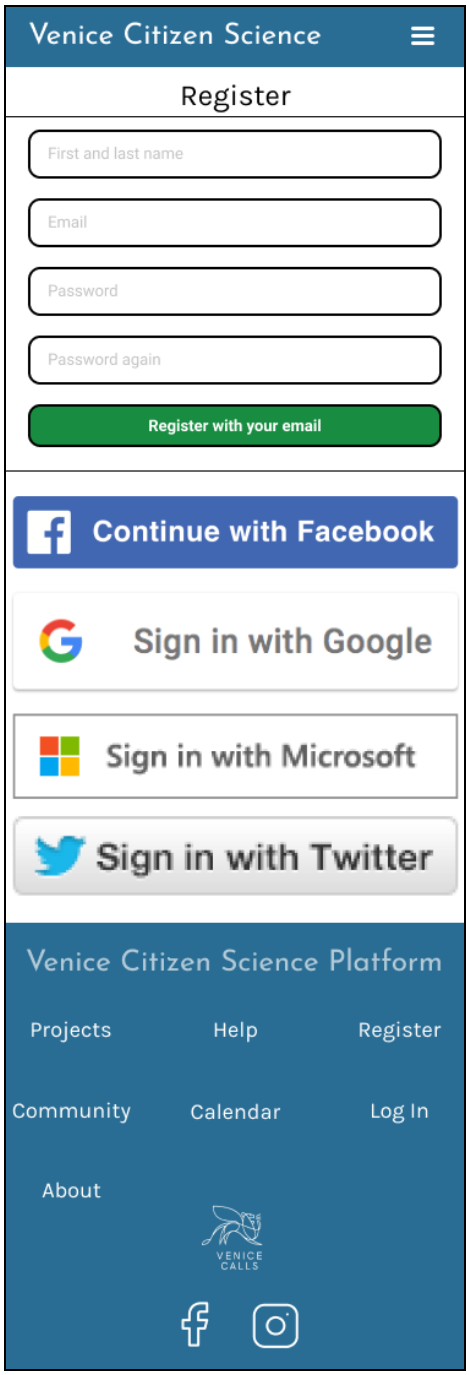
Community Discussions Page



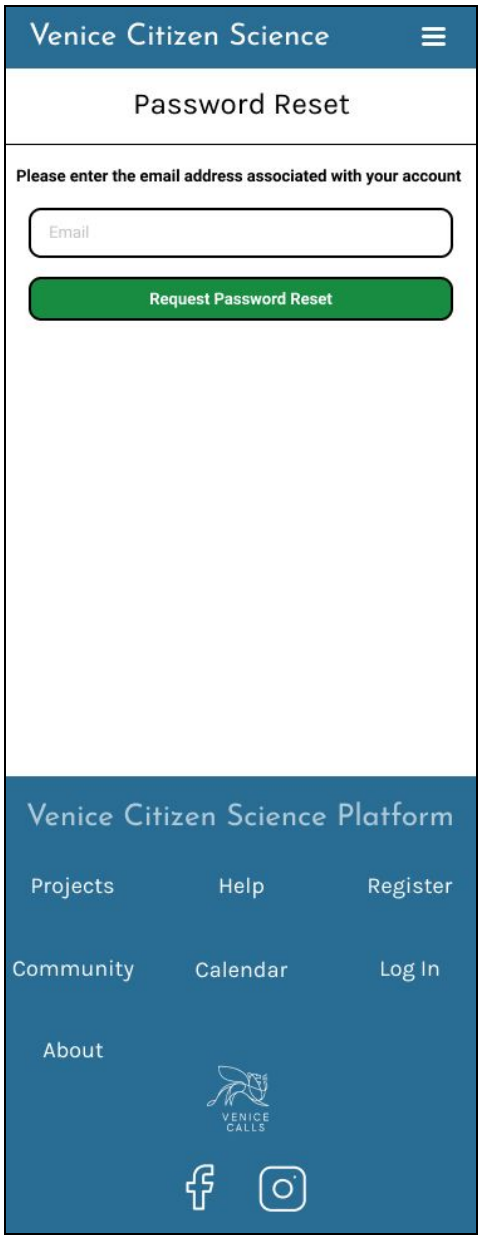
Login Page



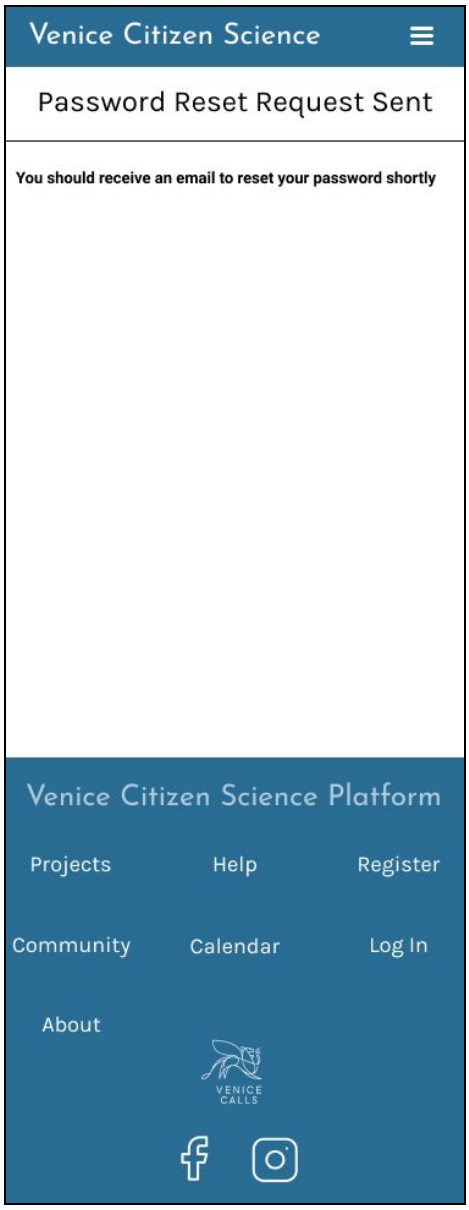
User Registration Page



Request Password Reset Page



Request Sent Page



User Registration Confirmation Page